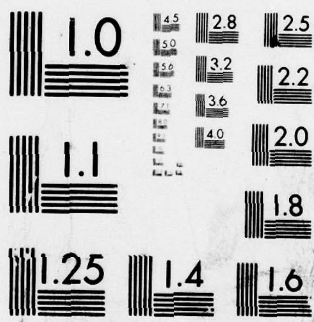
AD-A074 276 ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND WS--ETC F/G 4/2
EVALUATION OF THE SATURATION RESISTANT CROSSWIND SENSOR.(U)
JUL 79 R RODRIGUEZ, W J VECHIONE
UNCLASSIFIED ERADCOM/ASL-TR-0035 NL

| OF |

AD
A074276

END
DATE
FILMED
-10-79
DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

LEVEL II

(12)

AD

Reports Control Symbol
OSD 1366

ASL-TR-0035

AD A074276

EVALUATION OF THE SATURATION RESISTANT CROSSWIND SENSOR

July 1979

By

Ruben Rodriguez
William J. Vechione

Approved for public release; distribution unlimited

US Army Electronics Research and Development Command
ATMOSPHERIC SCIENCES LABORATORY
White Sands Missile Range, NM 88002

79 09 24 074

NOTICES

Disclaimers

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

The citation of trade names and names of manufacturers in this report is not to be construed as official Government indorsement or approval of commercial products or services referenced herein.

Disposition

Destory this report when it is no longer needed. Do not return it to the originator.

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ASL-TR-0035	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* 6 EVALUATION OF THE SATURATION RESISTANT CROSSWIND SENSOR		5. TYPE OF REPORT & PERIOD COVERED 9 Technical Report 6. PERFORMING ORG. ~~REPORT NUMBER~~
7. AUTHOR(s) 10 Ruben/Rodriguez ~~and~~ William J./Vechione		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Atmospheric Sciences Laboratory White Sands Missile Range, NM 88002		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 16 DA Task No. 1L162111AH71B3
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Electronics Research and Development Command Adelphi, MD 20783		12. REPORT DATE 11 July 1979 17 A3 13. NUMBER OF PAGES 68
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)* 14 ERADCOM/ASL-TR-0035		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 12 68p 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Crosswind	Wind sensor
Remote sensing	Anemometer evaluation
Anemometry	Wind velocity
Atmospheric probing	Optical measurements

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Integrated path crosswinds were measured at Biggs Optical Range, Biggs Army Airfield, Fort Bliss, Texas, during the period of 31 January to 8 March 1978 with the Saturation Resistant Crosswind Sensor, a bistatic system that measures crosswinds by detecting and analyzing the movement of atmospheric scintillations. Data collected with this sensor were compared to integrated path wind averages measured by the calibrated anemometer array. This report presents X-Y scatter plots, derived weighting functions, and wind measurement comparison plots. The results of the tests show that the major weighting (or

CONT

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

410 663

20. ABSTRACT (cont)

contribution of thermal turbulence) to the system optics with a 500-m baseline is centered about 350 m from the receiver and approximates a slope intercept form Y = 0.85X - 10.02. With a 2,000-m baseline, the weighting function maximum is shifted to about 1400 m and approximates the slope intercept form Y = 1.57X - 0.43.

ACKNOWLEDGMENT

The authors thank Messrs. Glenn Hoidale, David Favier, and William Hatch of the Atmospheric Sensing Division and Messrs. John Hines and Charles White of the Meteorological Support Division for their assistance in manning the Meteorological Optical Measuring System and the Optical Range at Biggs Army Airfield, Fort Bliss, Texas, during the conduct of the test.

CONTENTS

INTRODUCTION

The state of the atmosphere affects tactical Army operations and the contributing weapons systems employment. To increase the friendly forces' relative combat power, meteorological parameters must be measured at the time and location of the action. An important parameter in atmospheric measurements, particularly for ballistic weapon employment, is the projectile's trajectory integrated path crosswinds.

The purpose of this report is to present the results of the evaluation of the Saturation Resistant Crosswind Sensor (SRCS), a sensor designed to measure average path crosswinds. This evaluation is based on comparative data taken during the test period of 31 January to 8 March 1978 at Biggs Optical Range (BOR), Biggs Army Airfield, Fort Bliss, Texas. Included as part of the report are daily weather summaries of atmospheric parameters prevailing at BOR.

The SRCS is an active optical system designed to measure the average crosswind along a path from the receiver to the transmitter. Although the SRCS was tested under actual field conditions, the evaluation tests were conducted cognizant that the SRCS is presently a research instrument and not yet intended for prolonged field use without proper reconfiguration.

This report presents results of collected data and an evaluation and analysis that determine the accuracy, reliability, and applicability of the SRCS.

This work was accomplished by personnel of the Atmospheric Sensing Division, Atmospheric Sciences Laboratory under DA Task 1L162111AH71A3.

INSTRUMENTATION REQUIREMENT

Crosswinds along a ballistic projectile trajectory contribute significantly to the total weapon error. Walters[1] has shown that direct fire crosswind errors on representative armor projectiles are significantly greater than head and tail wind errors. To increase the first-round-hit probability, crosswinds must be accurately known immediately before firing. Knowledge and application of crosswind information to fire control systems can also increase the standoff range of friendly weapons without degrading weapon accuracy.

Several remote crosswind sensors have been developed in the recent past. Four systems were evaluated at BOR during the test period. The evaluation

---

[1]D. L. Walters, 1975, "Crosswind Weighting Functions for Direct-Fire Projectiles," ECOM Report 5570, Atmospheric Sciences Laboratory, White Sands Missile Range, NM

results of the SRCS are presented in this report. The results of the other system evaluations are reported separately.[2]

The SRCS, an active bistatic sensor that measures weighted average crosswinds,[3] can: (1) be used in research that may improve present wind measurement techniques, (2) aid in the characterization of the atmosphere, especially as related to high energy laser propagation effects, and (3) serve as a baseline system in evaluating and analyzing future wind measurement systems.

A previous experimental prototype of the SRCS[4,5] proved the concept of operational feasibility, but was unable to operate under conditions of high integrated refractive index turbulence which can occur on clear sunny days with path lengths over 500 m and less than 10 m above ground. In 1977, an exploratory development prototype of the improved sensor was completed. This is the system evaluated and discussed here. The evaluation of this sensor will contribute to the necessary data base for continued future crosswind sensor development to satisfy stated tactical requirements.

SYSTEM DESCRIPTION

The SRCS consists of a transmitter and a receiver placed at opposite ends of the path to be measured. The transmitter consists of a 55 W quartz-iodine lamp located at the focus of a Fresnel lens, and a power supply for the lamp. The receiver houses an optical section (consisting of a pair of photodiode detectors and situated close to the focal points of two 13 cm Fresnel lenses) and an electronic section that conditions the signals from the photodiodes and determines the slope of their covariance. Table 1 summarizes the SRCS characteristics, and figures 1, 2, and 3 show the unit that was evaluated.

---

[2]R. Rodriguez, 1979, "Evaluation of the Passive Remote Crosswind Sensor," ERADCOM Report, ASL-TR-0032, US Army Atmospheric Sciences Laboratory, White Sands Missile Range, NM

[3]G. R. Ochs, G. F. Miller, and E. J. Goldenstein, 1976, "A Saturation-Resistant Optical System for Measuring Average Wind," ECOM 76-2, Atmospheric Sciences Laboratory, White Sands Missile Range, NM

[4]R. S. Lawrence, G. R. Ochs, and S. F. Clifford, 1972, "The use of scintillations to measure average wind across a light beam," Appl Opt 11, No. 2, 239-243

[5]G. R. Ochs and G. F. Miller, 1973, "The NOAA optical system for measuring average wind," NOAA Technical Memorandum ERL WPL-9

TABLE 1. SATURATION RESISTANT CROSSWIND SENSOR CHARACTERISTICS

Receiver	
Function	Run and calibrate
Scale Switch	5, 10, 20 m/sec
Aperture Switch	Small, medium, large
Time Constant Switch	1, 10, 100 sec
Field of View	0.6 degree
Optics	Twin apertures with Fresnel lenses
Detectors	United Detector Technology pin spot 2D Photodiodes (pair)
Size	25 x 30 x 45 cm
Power Requirements	120 V AC
Transmitter	
Light Source	Quartz-iodine 55 W 12 V DC at focus of Fresnel lens
Power Requirements	120 V AC

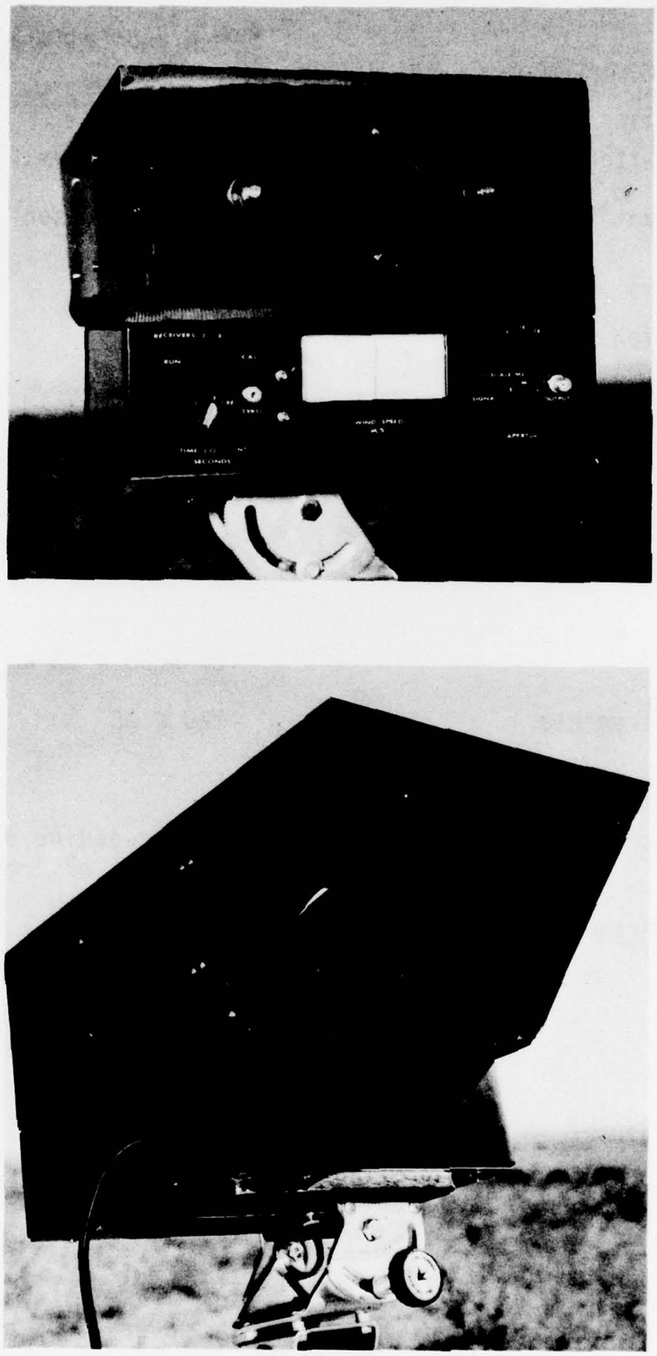


Figure 1. Saturation Resistant Crosswind Sensor Receiver (rear and oblique views).

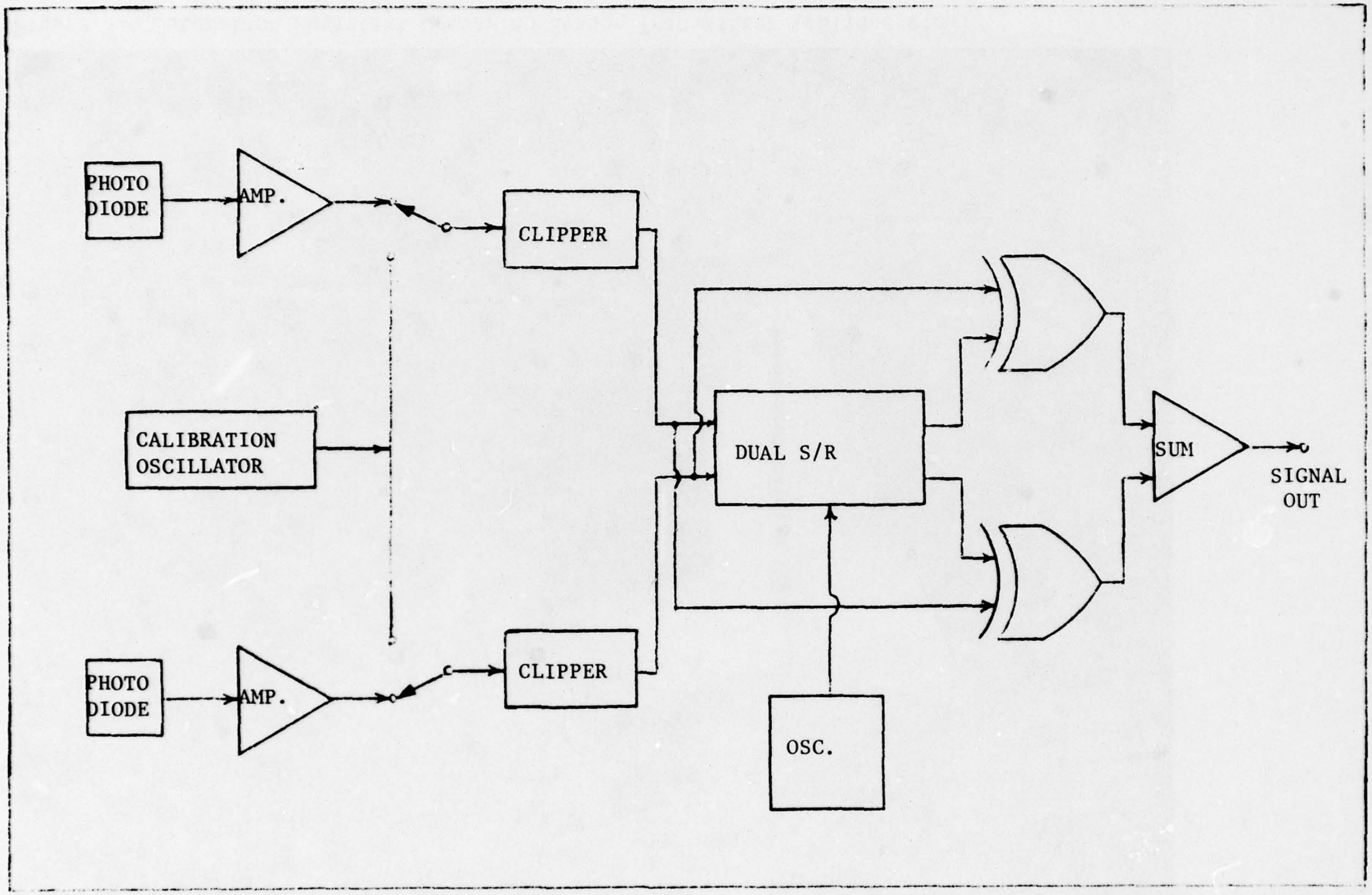


Figure 2. Saturation Resistant Crosswind Sensor Block Diagram.

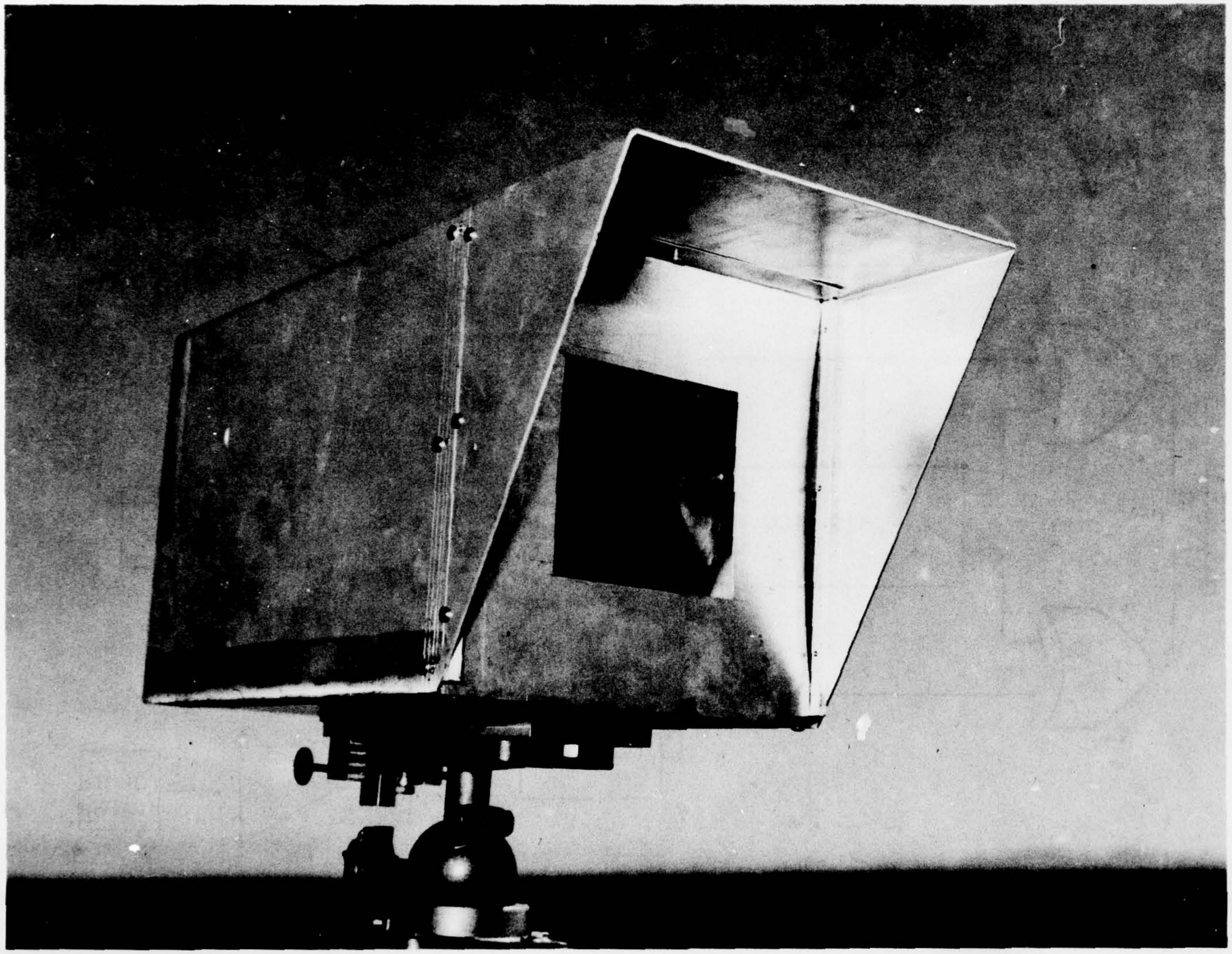


Figure 3. Saturation Resistant Crosswind Sensor Transmitter (oblique view).

The operation of the SRCS is based on detection of the scintillation patterns produced by thermal gradients and transported by the wind. As each one of the photodiodes detects the incoming signal,[6] the fluctuations in irradiance are combined by the analyzer to obtain a covariance function. The slope of this curve, at zero delay time, is proportional to the time needed for a particular scintillation pattern to travel from one detector to the other. Since the distances between photodiodes are constant, the analyzer then derives the wind velocity from the slope of the covariance function. Figure 2, a block diagram of the SRCS, illustrates the electronic circuitry required.

TEST SUPPORT

Biggs Optical Range

The BOR is located approximately 400 m northwest of the main runway at Biggs Army Airfield, Fort Bliss, Texas. The range consists of an instrumented path at a heading of 49 degrees from True North and 2064 m long. Two 3.5-m towers are located at the end points of the path with a 3-m tower aligned at the 500-m point of the path. These towers provide solid test beds for electro-optical instrumentation. A linear array of 3-m high anemometers parallel to the path is offset 3 m to the southeast of the optical path. The anemometers are oriented to measure northwest-southeast winds, i.e., "cross" winds to the optical path. This array consists of 21 anemometers spaced 25 m apart for the first 500 m path length and 15 anemometers spaced 100 m apart for the remaining 1500 m of path length. Figure 4 shows the BOR with the SRCS in the foreground.

The instrumentation path is specifically designed to test optical wind measurement systems because the surrounding terrain features are flat and the optical path has been cleared of natural vegetation to minimize wind flow field characteristics.

Meteorological Optical Measuring System

The Meteorological Optical Measuring System (MOMS) (figure 5) is a mobile, self-contained data collection and reduction system containing analog and digital subsystems specifically engineered for the measurement and recording of atmospheric meteorological data. The system uses an HP 2100 computer system as a controller and is managed by an in-house developed program that samples the various sensors at present rates,

---

[6]G. R. Ochs, S. F. Clifford, and Ting-i Wang, 1976, "Laser Wind sensing: the effects of saturation of scintillation," Appl Opt, 15, No. 2, 403-408

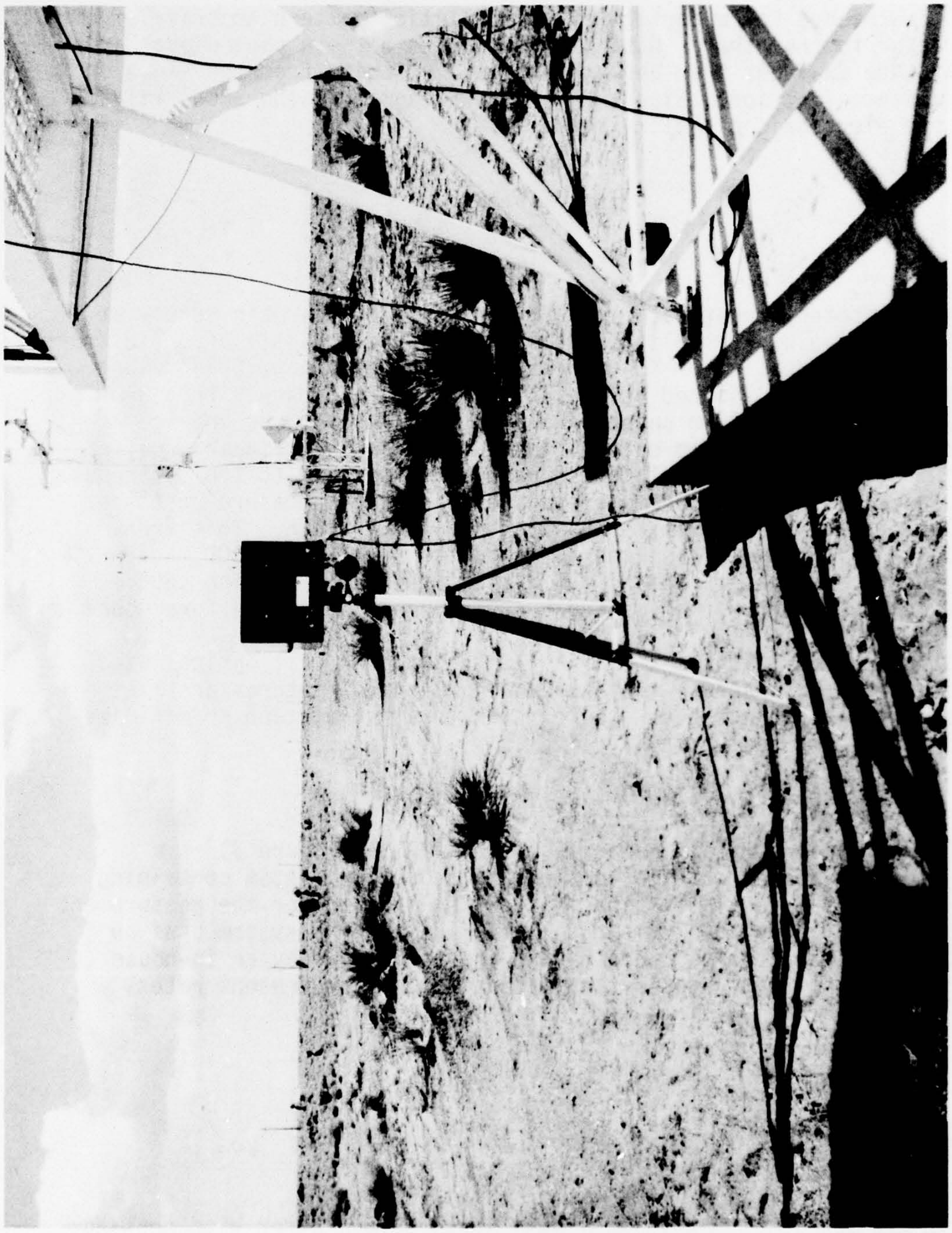


Figure 4. Biggs Optical Range.

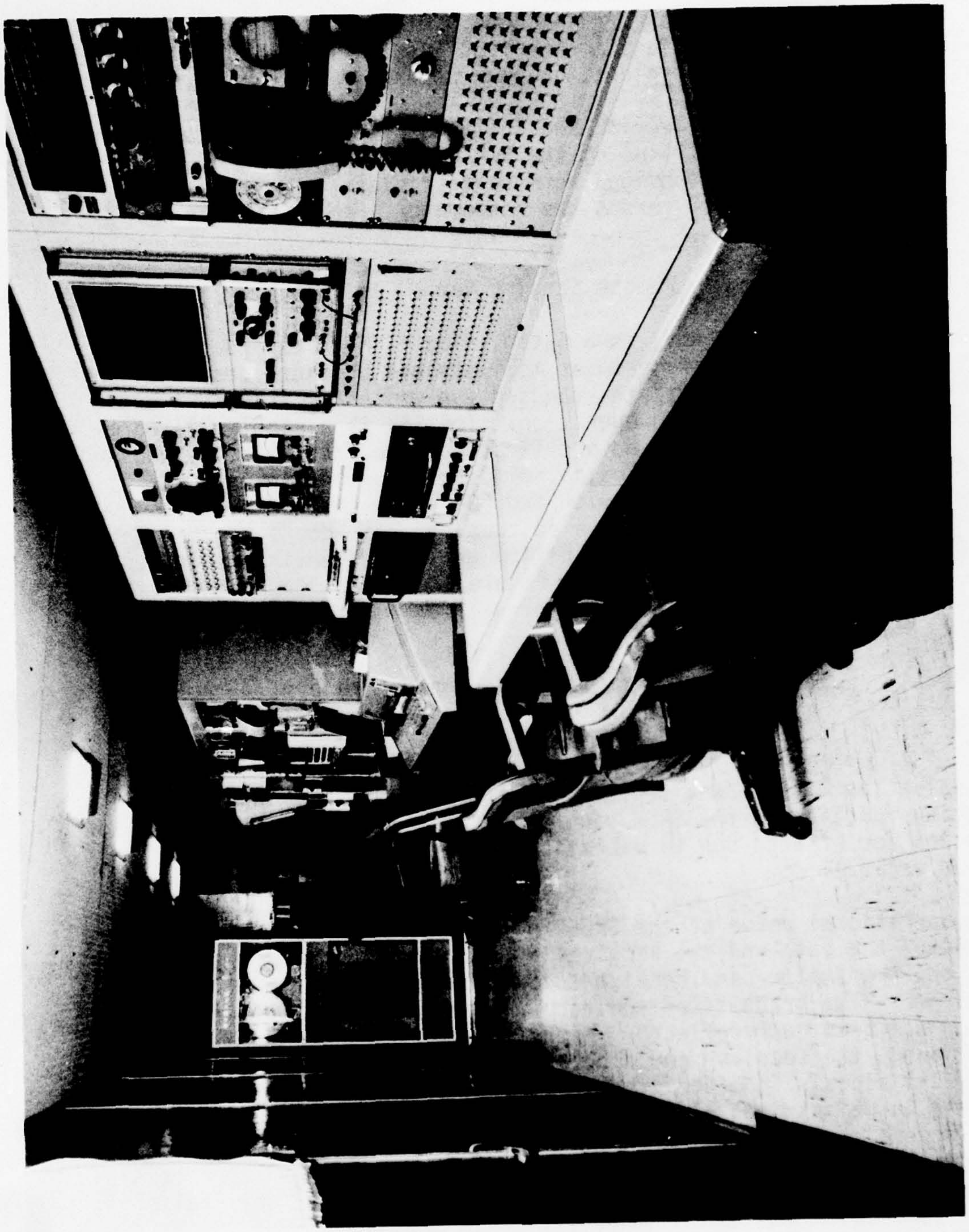


Figure 5. Meteorological Optical Measuring System.

stores these data, and then reduces and analyzes these data according to the program. Output format capabilities are raw scatter graphs, time averaged plots, printer, limited strip chart, and digital tape.

During these tests, analog wind data from the anemometer array and the SRCS output were recorded on digital tape. Other meteorological data simultaneously recorded were atmospheric pressure, temperature, refractive index structure coefficient, and dew point.

As a part of the data collection and analysis effort, data reduction was conducted both on and off line by the FORTRAN program shown in appendix D. The primary results provided were scatter plots and weighting function diagrams of the SRCS versus the anemometer array.

Remote Sensing Van

The Remote Sensing Van (RSV) is a 5-ton, 6 by 6, M820 expandable van which contains inherent prime-mover mobility and provides test-bed facilities. The van "folds" to standard van width for transport and expands to 4.3 m for in situ operation. The RSV is a stable platform for optical equipment tests and provides test-bed facilities by housing test equipment and ancillary dedicated test support equipment. An environmental isolation screen with two 30- by 45-cm integral glass plates has been fabricated for use so that the rear doors can be opened for optics line-of-sight test capability while test environmental conditions are retained inside the RSV. *Figure* 6 shows a "downrange" view of the RSV in operating configuration.

TEST DESCRIPTION, CONDUCT, AND PROCEDURES

General

The evaluation mission was twofold: (1) determining the accuracy and weighting function of the SRCS and (2) testing SRCS operational characteristics for effects due to vibration and weather conditions (i.e., rain, overcast).

Range operational setup of the SRCS involved placing the transmitter at one end of the path and the receiver at the other end. To insure operation, the transmitter and receiver should be focused accurately toward each other. The transmitter could be aligned easily and rapidly by placing a 7.5-cm retroreflector on the receiver. After the transmitter was aligned, the receiver could be successfully aligned by observing electrical signals from the "test" outputs while slowly slewing the receiver in azimuth and elevation until the strongest scintillation signals were observed from both channels. When the alignment procedure was completed, both receiver and transmitter units were secured to avoid any deterioration of the signal-to-noise ratio (SNR) and any "false" signal generation due to vibration.

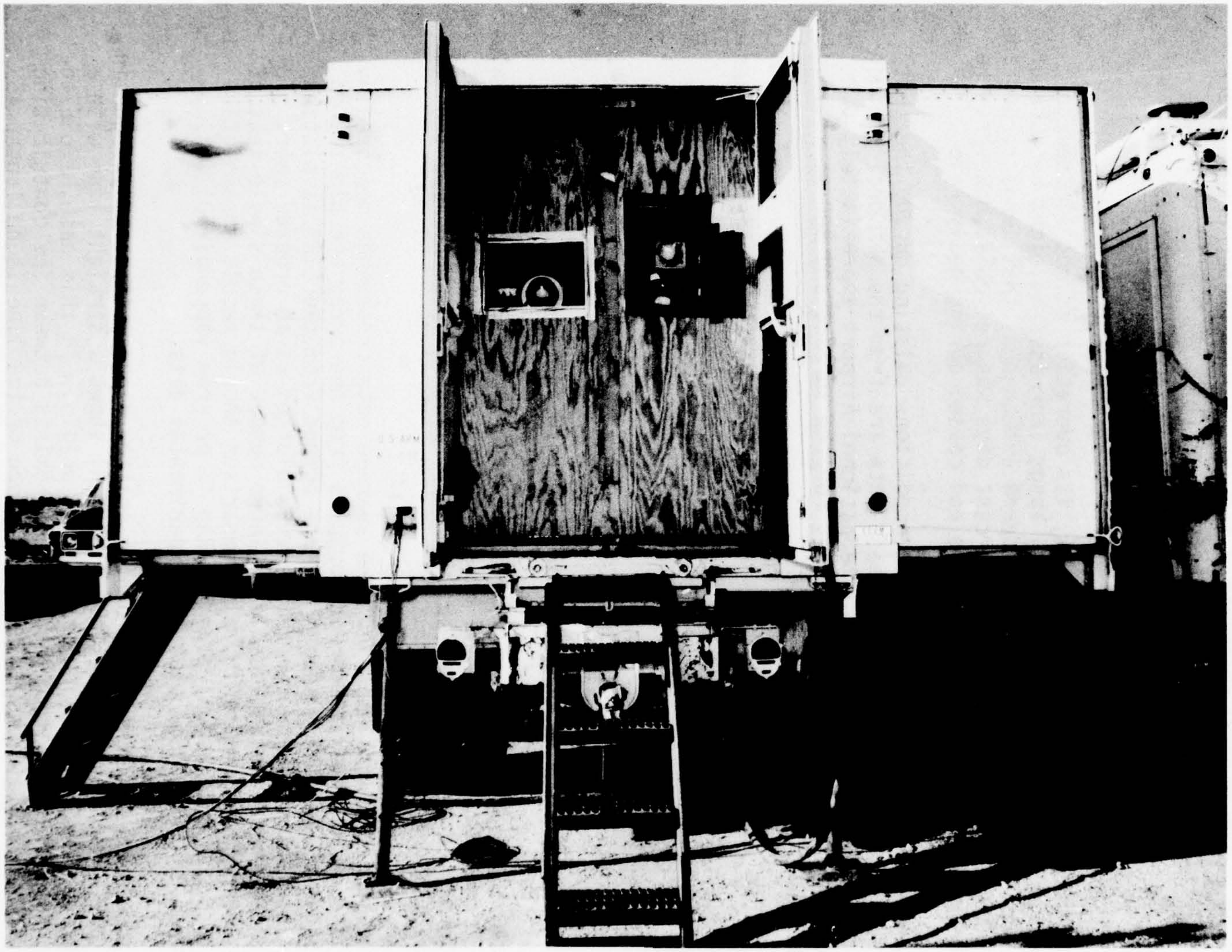


Figure 6. Remote Sensing Van.

Ranges

The SRCS was tested at 500-m and 2000-m path lengths. SNR at 500 m was relatively high and proper lockon was readily obtained. Extending the operating range to 2000 m decreased the SNR, but by proper transmitter-receiver alignment, lockon was achieved.

Weather Conditions

Because the SRCS is an active system, its operation is not limited to daytime use. In fact, the operating range increases at night because of the absence of ambient light (considered extraneous) that tends to degrade the SNR. Operation on clear or overcast days was reliable; however, the operation became erratic during rain and ceased during heavy rain.

A detailed daily summary of weather conditions existing during the test period is shown in appendix C. These data are from the National Weather Service located at the El Paso International Airport approximately 6 km from BOR. A synoptic weather summary for the surface and 500 mb altitude is also shown.

Atmospheric conditions of thermal turbulence ranged from very low or non-existent (during periods of rainfall) to values large enough to cause saturation of other crosswind systems.

DATA COLLECTION AND RESULTS

Mathematical Background

In statistical bivariate analysis, a scatter plot is useful for the evaluation of measured experimental data. During these tests, scatter plots were generated because the resultant comparison values were important for determination of accuracy.

For the scatter plots employed, the average path crosswinds measured by groupings of weighted anemometer outputs from the array are plotted on the abscissa, and the measured average output from the SRCS is plotted on the ordinate. These two values were plotted as an ordered pair. To make this comparison applicable, a large number of these single sets of values had to be compared. This comparison should result in a statistically sound conclusion. The FORTRAN IV program (appendix D) was developed to sample and plot the experimental data.

The usefulness and simplicity of the scatter diagram is readily shown in figure 7. The first scatter plot (plot A) shows a straight line with a 45-degree slope and passing through the origin. In this case, a one-to-one correspondence (complete agreement) exists between the contributing systems. Plot B differs in that the slope of the line is no longer 45 degrees. This case indicates that the ordinate values have to be

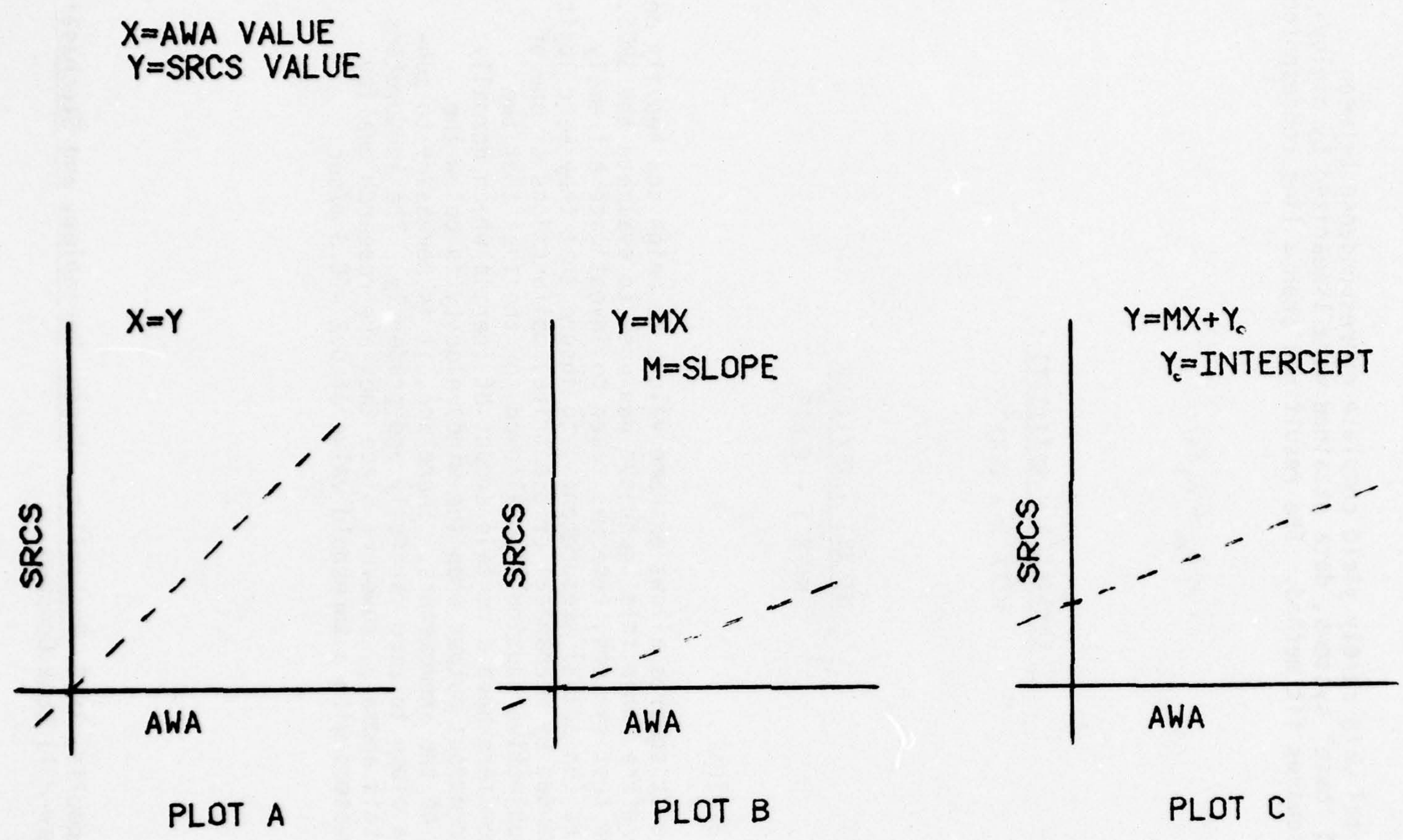


Figure 7. Typical scatter plots. Windspeed values measured by the SRCS are plotted versus values measured by a reference, in this case, the analog wind averager.

adjusted by including a constant multiplicative factor (m). Plot C shows the resultant line no longer passing through the origin. This signifies the ordinate values have to be further adjusted by including an offset value Y_o.

Since experimental data rarely yield complete correspondence between test system and "base" systems, data obtained were linearized by employing the least squares fit method. The result was then a line represented as

$$Y = A_o + A_1X,$$

where[7]

$$A_o = \frac{(\Sigma Y)(\Sigma X^2) - (\Sigma X)(\Sigma XY)}{N(\Sigma X^2) - (\Sigma X)^2}$$

and

$$A_1 = \frac{N(\Sigma XY) - (\Sigma X)(\Sigma Y)}{N(\Sigma X^2) - (\Sigma X)^2}$$

N = number of samples.

The method of least squares allows extreme values to weigh too heavily on the result; therefore, when this technique was used to evaluate the SRCS, as well as other test systems, care was taken to investigate extremely large differences (on actual measurements) to insure that they were legitimate and not caused by mechanical or electrical malfunctions of one of the systems. Subjective caution also allowed for the fact that the mechanical anemometers have a certain amount of inertia which normally results in an erroneous output when the wind velocity is below the threshold value of the anemometers. Therefore, it is necessary to consider the values close to zero carefully and prudently. The anemometers used minimized this anomaly, however, since they are research quality propeller anemometers with a threshold value of 0.2 - 0.3 m/sec.

---

[7]Anthanasios Papoulis, 1965, Probability, Random Variables, and Stochastic Processes, McGraw-Hill Book Company

Scatter plots can be generated by using either straight average or weighted average values from the analog wind averager (AWA) as the abscissa point input. First, plots were generated by using straight average values; in later tests, after the weighting function of the SRCS had been determined, scatter plots with weighted average values from the AWA were generated.

Both types of plots are illustrated in appendix A; however, more emphasis is given to the weighted value plots.

Before these weighted values could be used, the SRCS weighting function had to be determined. The weighting functions were computed by considering different groups of anemometer outputs as a least squares basis set; that is, the SRCS wind measurements, denoted by W_s, are represented as a linear combination of m different groups of anemometer outputs, W_i, so that

$$W_s = \sum_{i=i}^{m} a_i W_i,$$

where a_i are the correlation coefficients determined by the m^{th} order least squares analysis. Various sets of coefficients, a_i, were obtained by employing different groupings of anemometers; and since the range is 2 km long, it was possible to obtain a weighting function out to that distance.

Results of Data Analysis

The weighting function and scatter plots obtained from the collected data are compiled in appendix A for easy reference. Figure 8 is a representative plot that exemplifies the method of data presentation. For this case, the SRCS data closely followed the AWA data, as can be seen by the dashed line which approaches quite well the solid (45-degree) line. The weighting function graph illustrates the preponderance of weighting from 250 m to 400 m with a maximum at approximately 350 m. For the sake of completeness, figure 8 is replicated and included with the rest of the reduced data in appendix A. In summary, for a path length of 500 m the values of the SRCS are related to those of the AWA if the following formula $Y = 0.85X - 10.02$ and the weighting function show that crosswinds located from 250 to 400 m are weighed most heavily. For the 2000-m path, the previous results were shifted somewhat to yield $Y = 1.57X - 0.43$ and the path length weighed most heavily is from 1000 to 1700 m.

Appendix B contains the comparison graphs of the SRCS versus the AWA as a function of time. Comparison of these values yielded a measure of

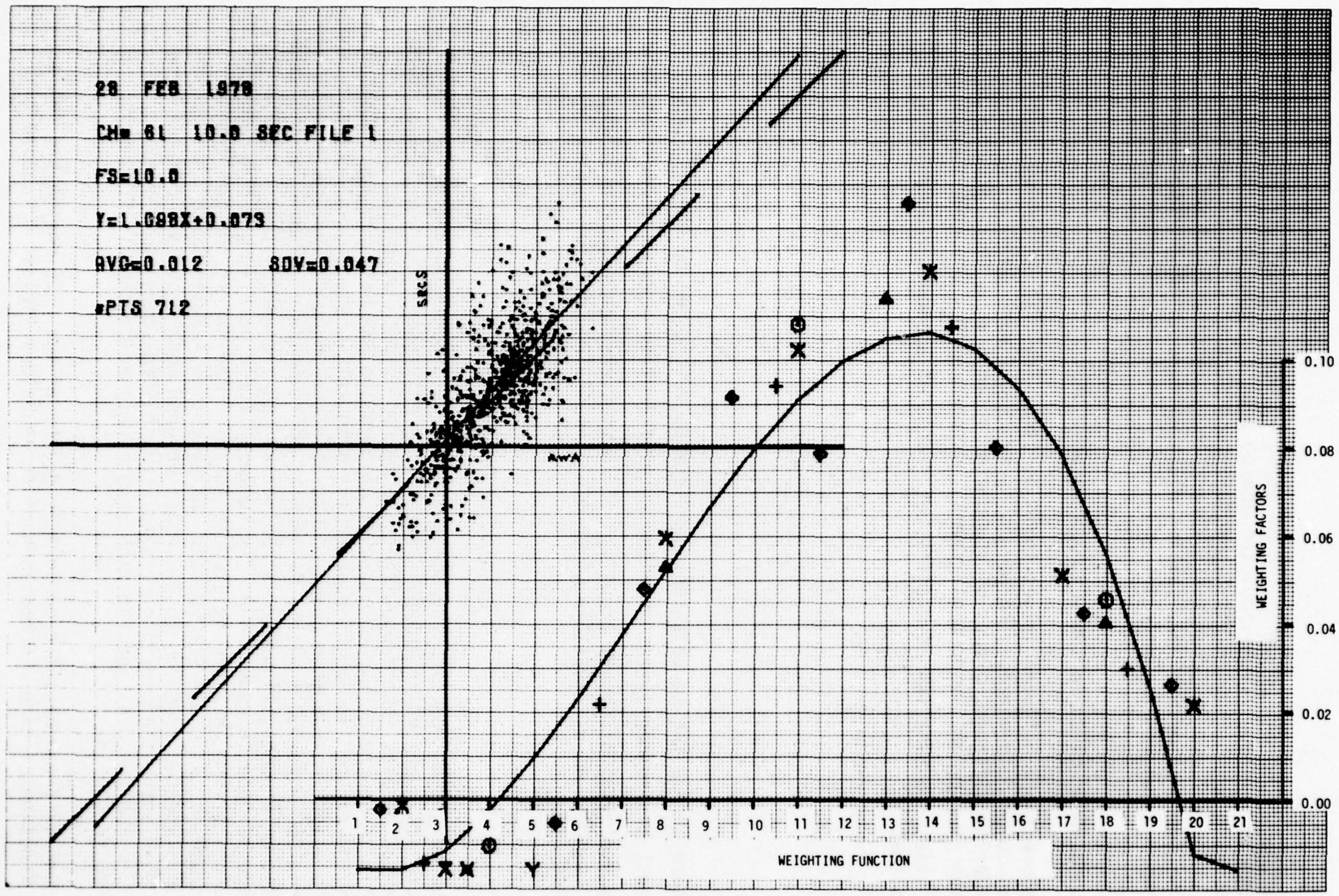


Figure 8. SRCS scatter plot and weighting function at 500 m range.

accuracy. Calculations show that the crosswind values measured by the SRCS were within 8 percent of those measured by the AWA at least 81 percent of the time.

The program included in appendix D was used to collect, reduce, and plot the data presented in this report and is not discussed per se in this report.

Although the weighting function derived for the SRCS with a 500-m range is not exactly the same as the one derived with a 2000-m range, values calculated from them are within 15 percent of each other. To determine the exact cause of the discrepancy, more data than what were collected during the test period would have to be gathered and analyzed statistically.

CONCLUSIONS

Under predominant area weather conditions (no rain, hail, or snow), the SRCS measured crosswind averages within 8 percent of those measured by the AWA. However, under moderate to severe adverse weather conditions, the SRCS was not accurate or reliable in operation, due to a decrease of SNR below its operating threshold. Both units of the SRCS should be solidly attached to a firm foundation to eliminate any vibration, since such vibration will be interpreted as crosswind signal information and thus yield erroneous results.

The calculated SRCS weighting functions indicate that crosswinds closer than 1/5 of the path from the receiver or closer than 1/10 of the path from the transmitter affect its output reading minimally, while crosswinds at the central section of the path affect the output predominately.

The SRCS transmitter can easily be aligned by using a retroreflector at the receiver and a boresighted telescope at the transmitter end. The receiver can then be aligned by observing the signals out of the "test" connectors and minutely slewing the receiver slowly until maximum scintillation readings are obtained at both connectors.

The SRCS can aid in the characterization of the atmosphere, serve as a reference to evaluate future wind measurement systems, and help advance research on wind measurement techniques.

The use of the SRCS is particularly applicable for crosswind measurements during conditions of high thermal turbulence or over long path lengths where other crosswind measurement systems have exhibited optical saturation.

Two weighting functions, instead of one, were derived for the SRCS to have a higher accuracy of values read. However, if only one is desired, an average weighting function could be obtained, with a corresponding decrease in accuracy.

REFERENCES

1. Walters, D. L., 1975, "Crosswind Weighting Functions for Direct-Fire Projectiles," ECOM Report 5570, Atmospheric Sciences Laboratory, White Sands Missile Range, NM.

2. Rodriguez, R., 1979, "Evaluation of the Passive Remote Crosswind Sensor," ERADCOM Report ASL-TR-0032, US Army Atmospheric Sciences Laboratory, White Sands Missile Range, NM.

3. Ochs, G. R., G. F. Miller, and E. J. Goldenstein, 1976, "A Saturation-Resistant Optical System for Measuring Average Wind," ECOM Report 76-2, Atmospheric Sciences Laboratory, White Sands Missile Range, NM.

4. Lawrence, R. S., G. R. Ochs, and S. F. Clifford, 1972, "The use of scintillations to measure average wind across a light beam," Appl Opt 11, No. 2, 239-243.

5. Ochs, G. R., and G. F. Miller, 1973, "The NOAA optical system for measuring average wind," NOAA Technical Memorandum ERL WPL-9.

6. Ochs, G. R., S. F. Clifford, and Ting-i Wang, 1976, "Laser Wind sensing: the effects of saturation of scintillation," Appl Opt 15, No. 2, 403-408.

7. Papoulis, Anthanasios, 1965, Probability, Random Variables, and Stochastic Processes, McGraw-Hill Book Company.

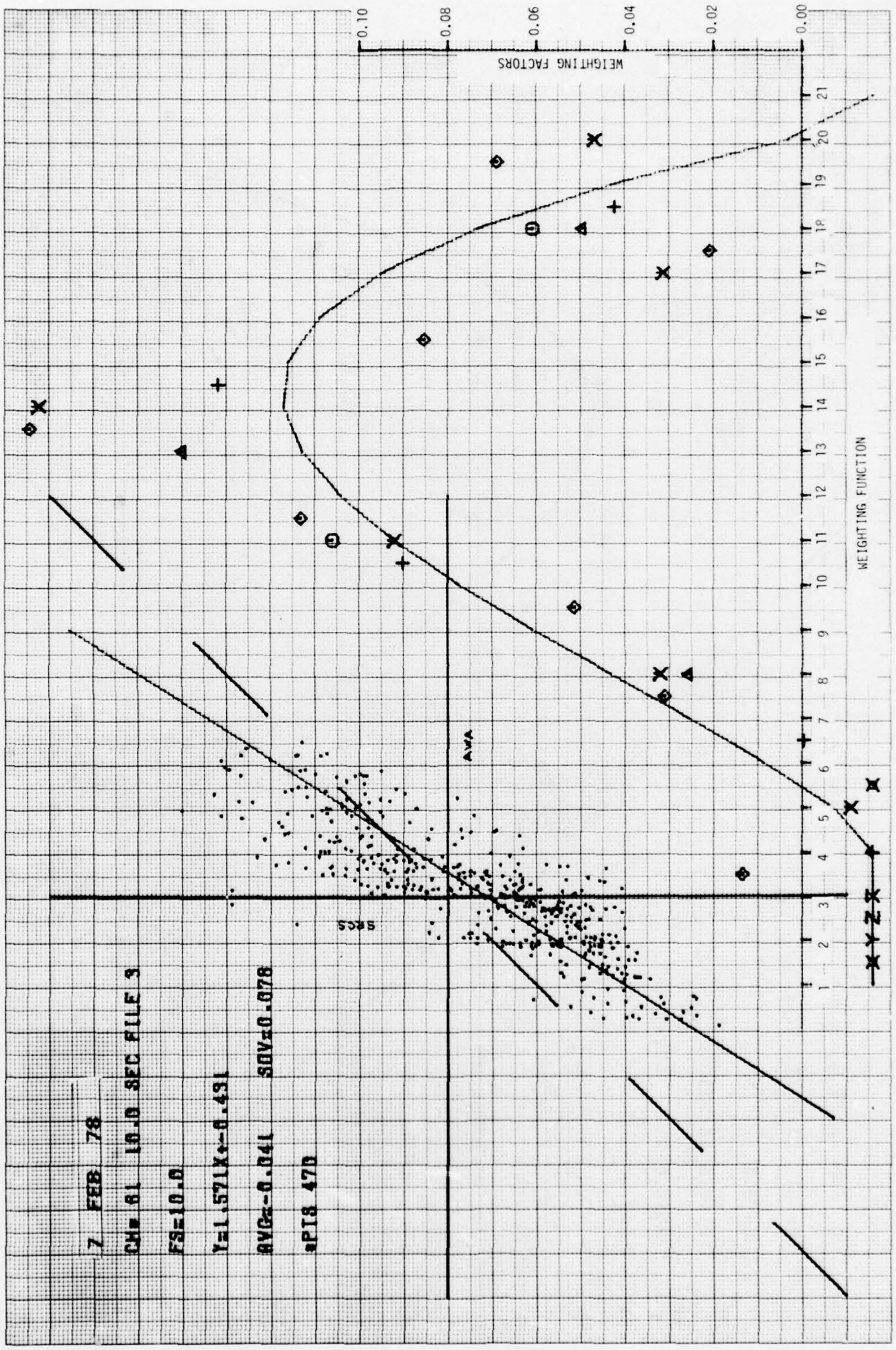


Figure A-1. SRCS scatter plot and weighting function (range 2000 m).

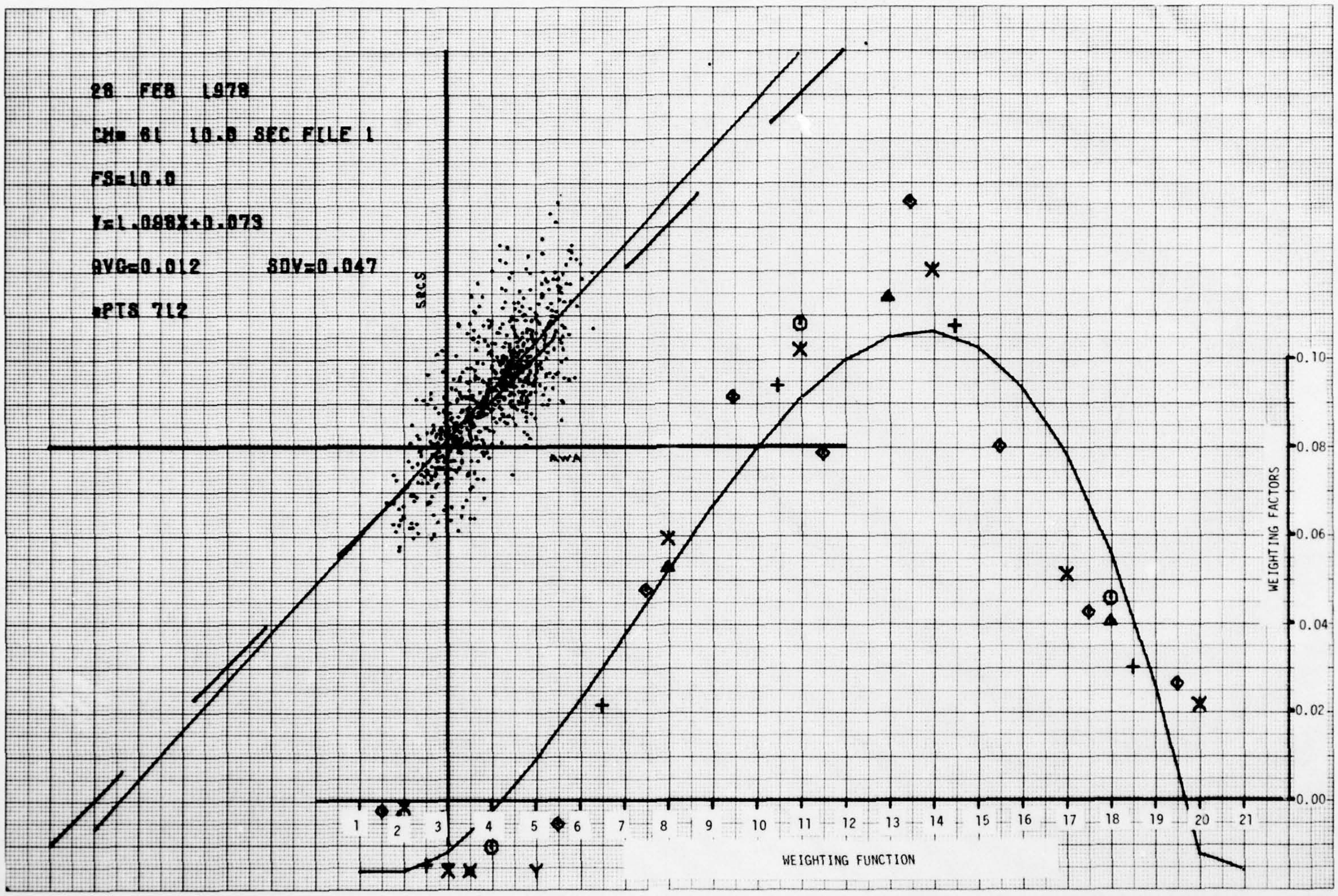


Figure A-2. SRCS scatter plot and weighting function (range 500 m).

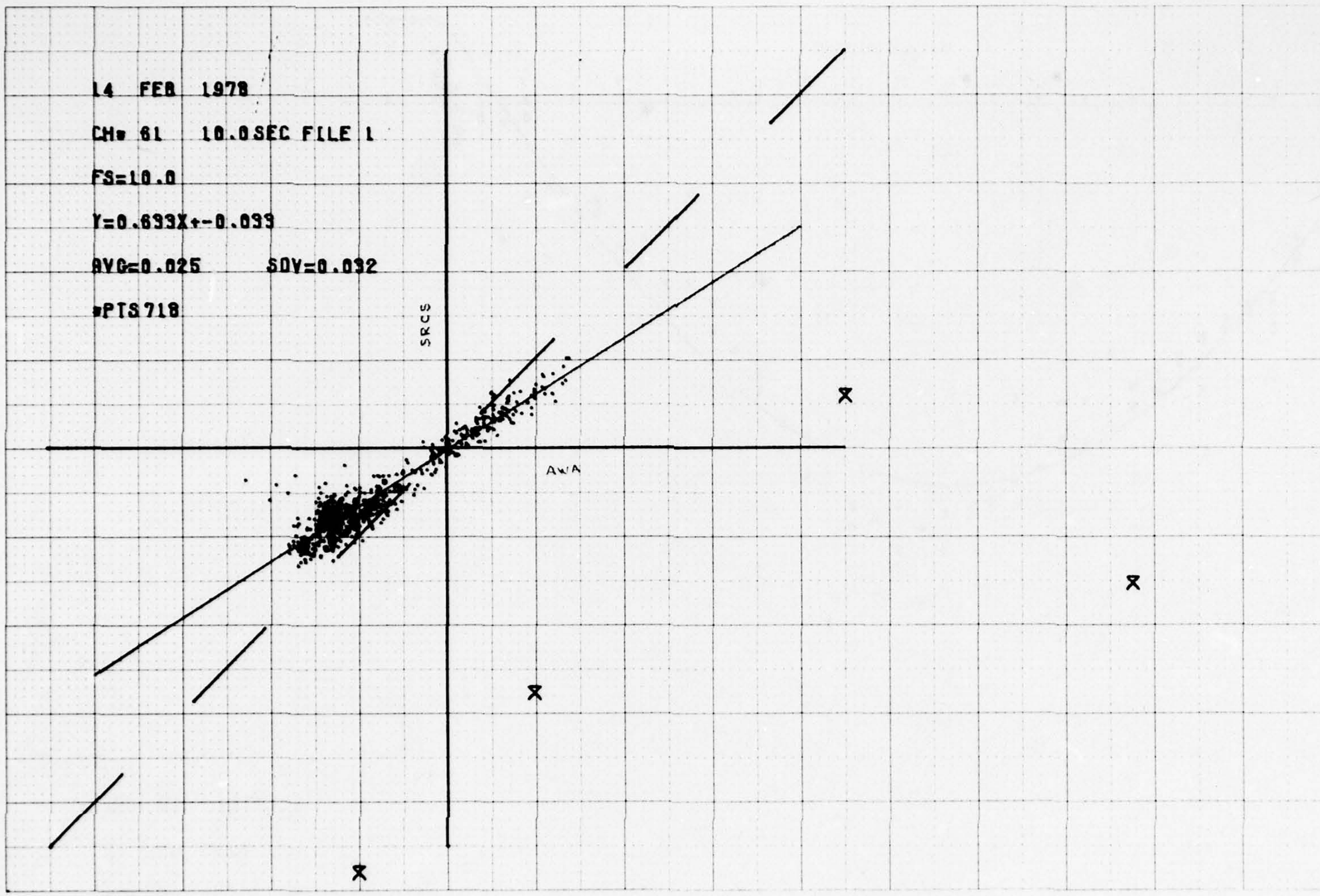


Figure A-3. SRCS scatter plot (range 500 m).

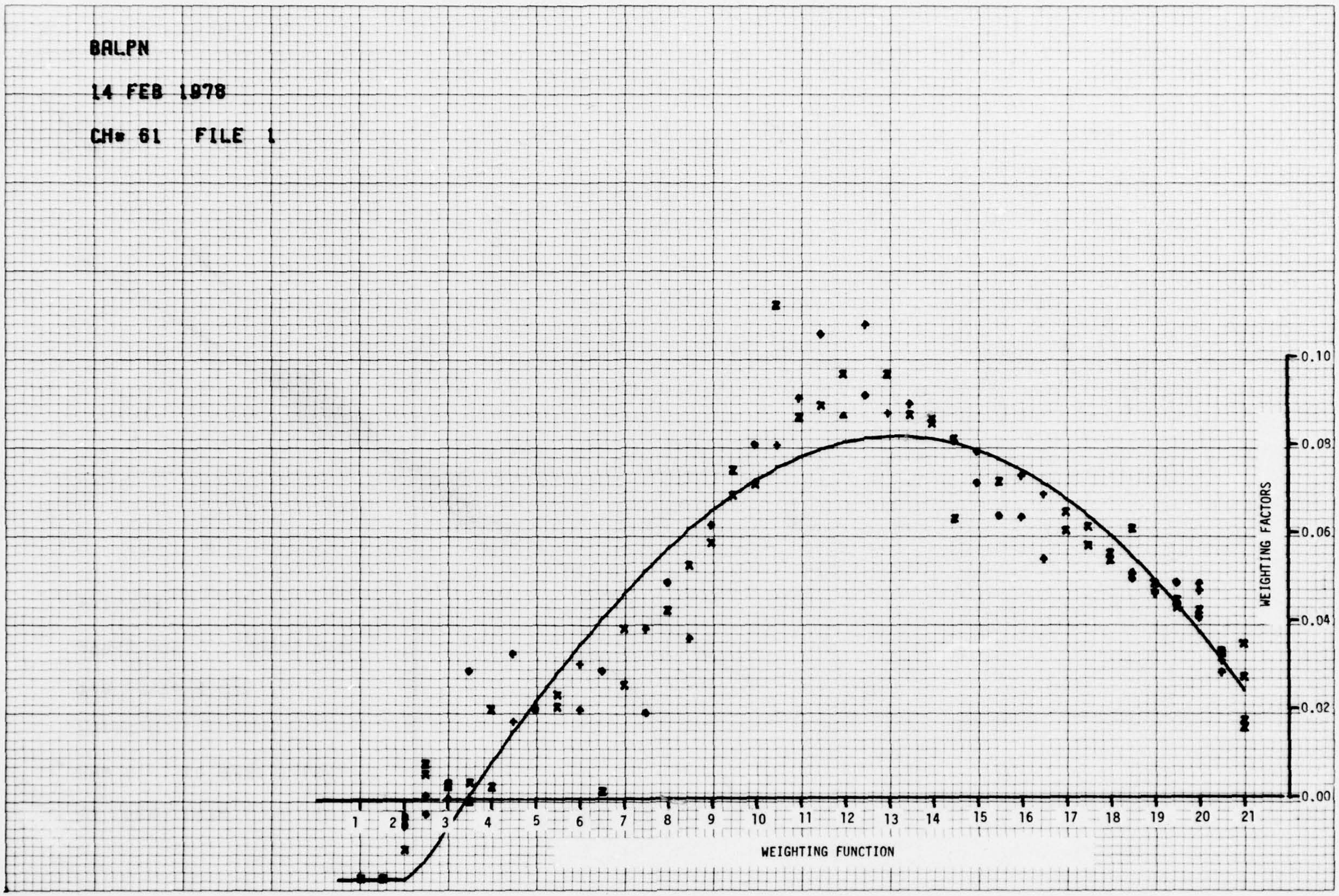


Figure A-4. SRCS weighting function (range 500 m).

APPENDIX B. SRCS WIND MEASUREMENT COMPARISON PLOTS

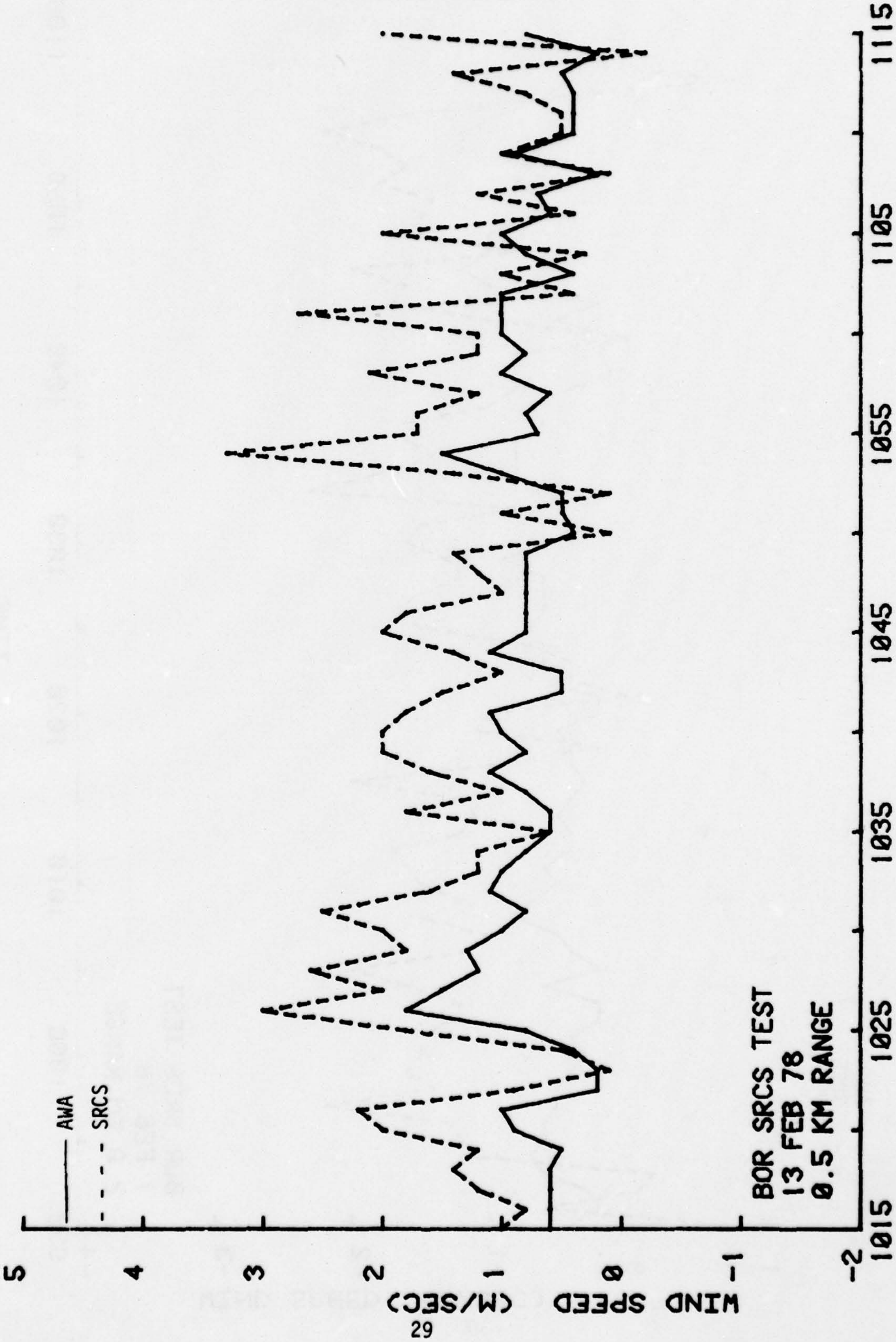


Figure B-1. SRCS wind comparison plot, 13 Feb 78, 0.5 km range, 1015-1115 hours.

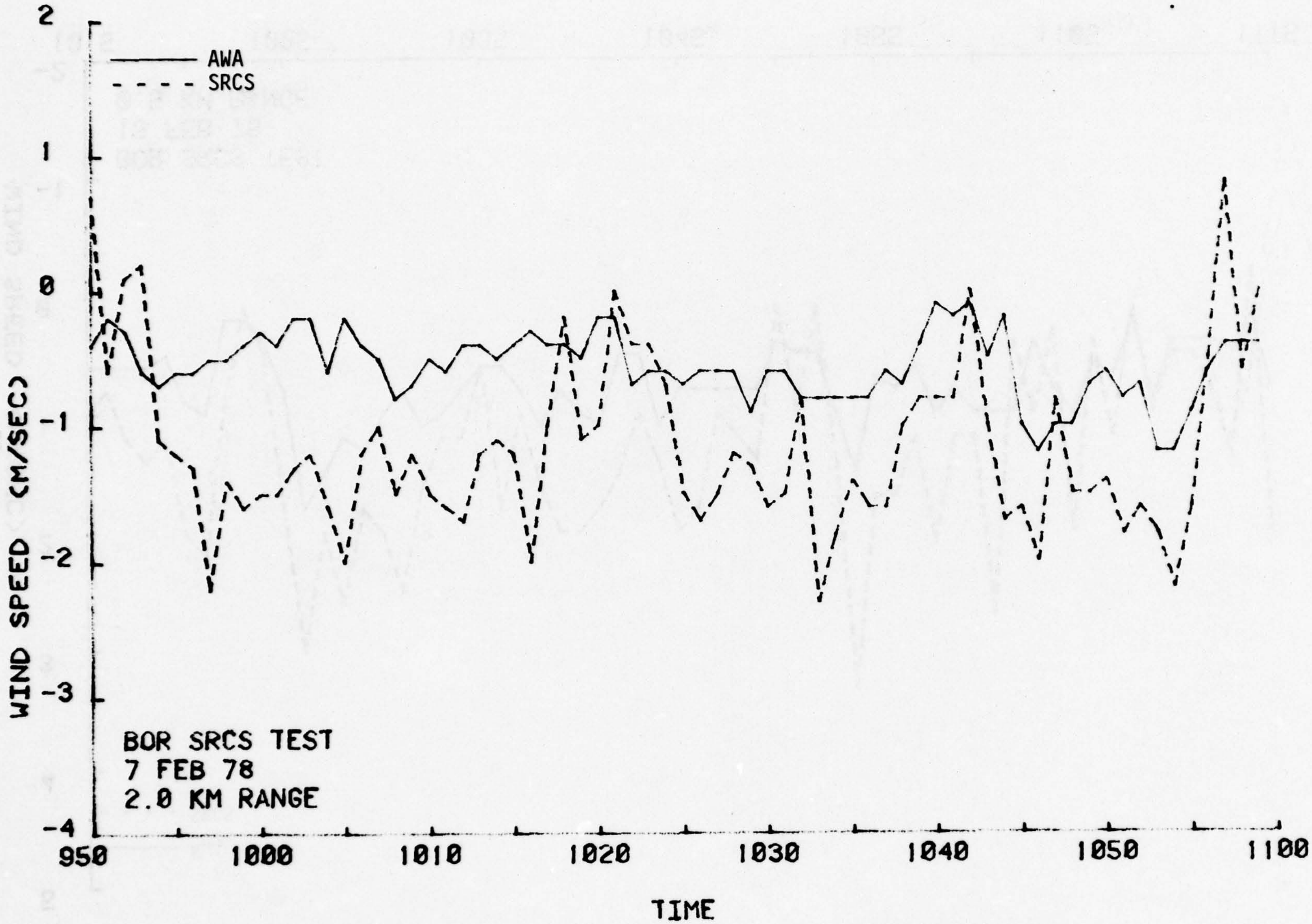


Figure B-2. SRCS wind comparison plot, 7 Feb 78, 2.0 km range, 0950-1100 hours.

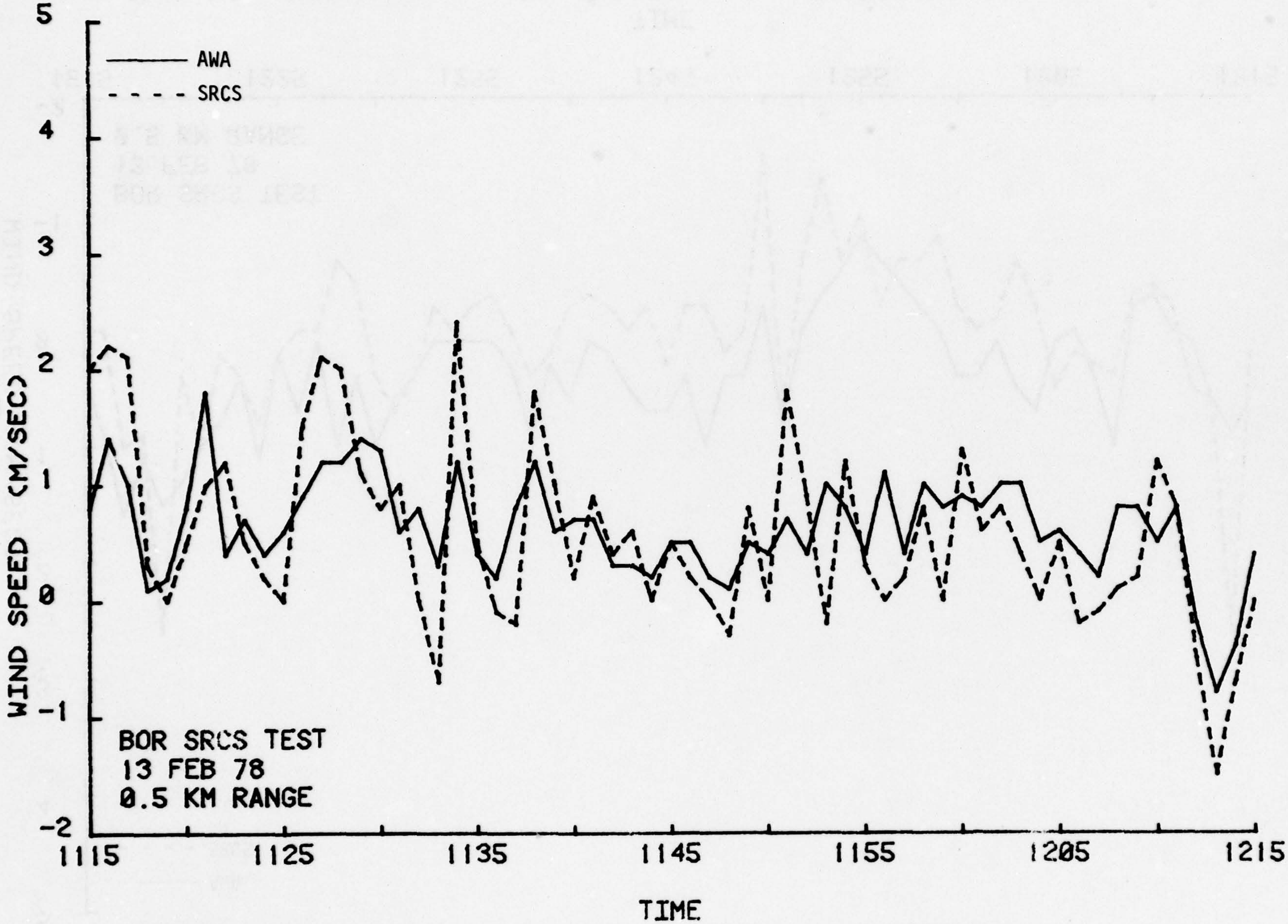


Figure B-3. SRCS wind comparison plot, 13 Feb 78, 0.5 km range, 1115-1215 hours.

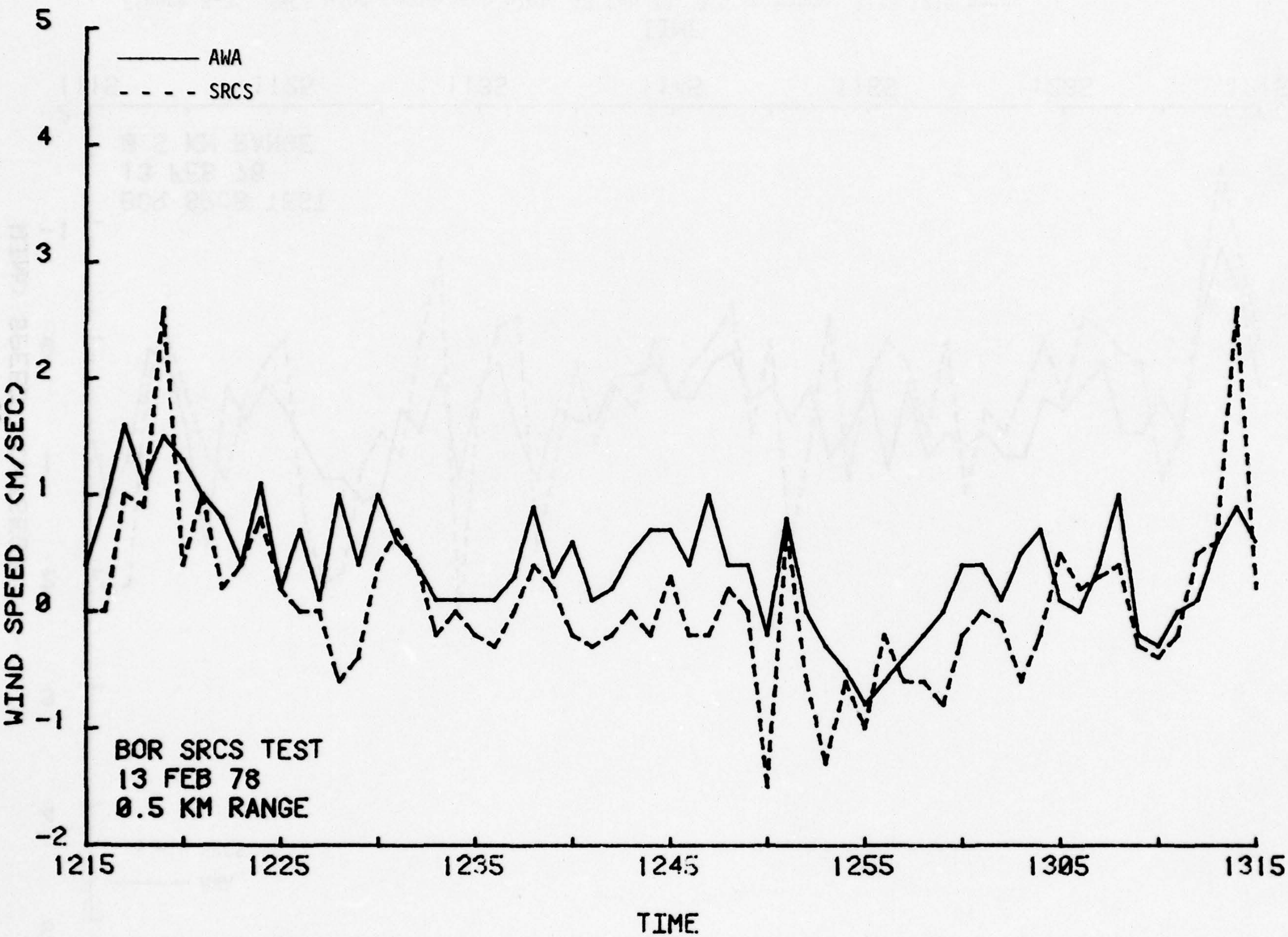


Figure B-4. SRCS wind comparison plot, 13 Feb 78, 0.5 km range, 1215-1315 hours.

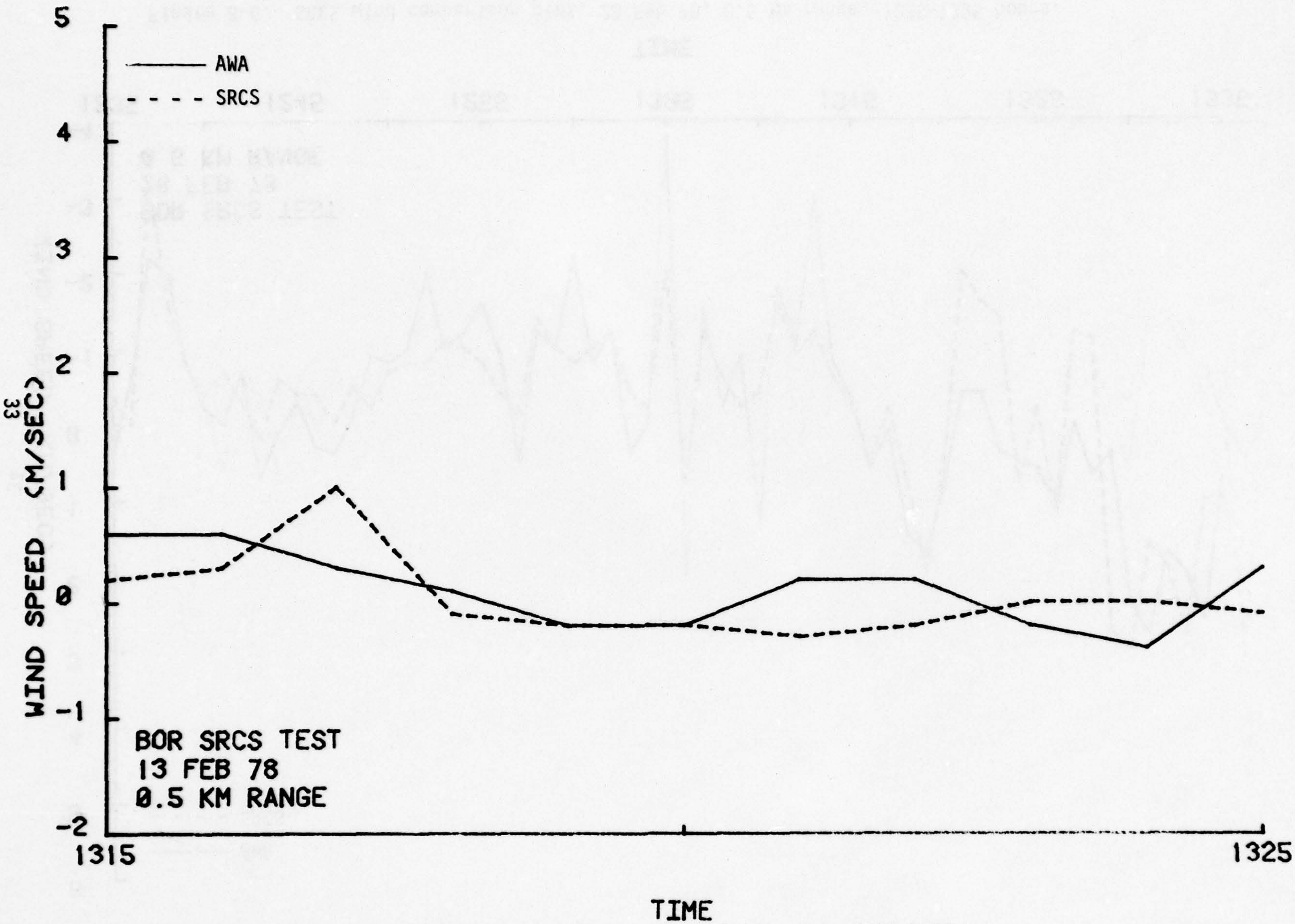


Figure B-5. SRCS wind comparison plot, 13 Feb 78, 0.5 km range, 1315-1325 hours.

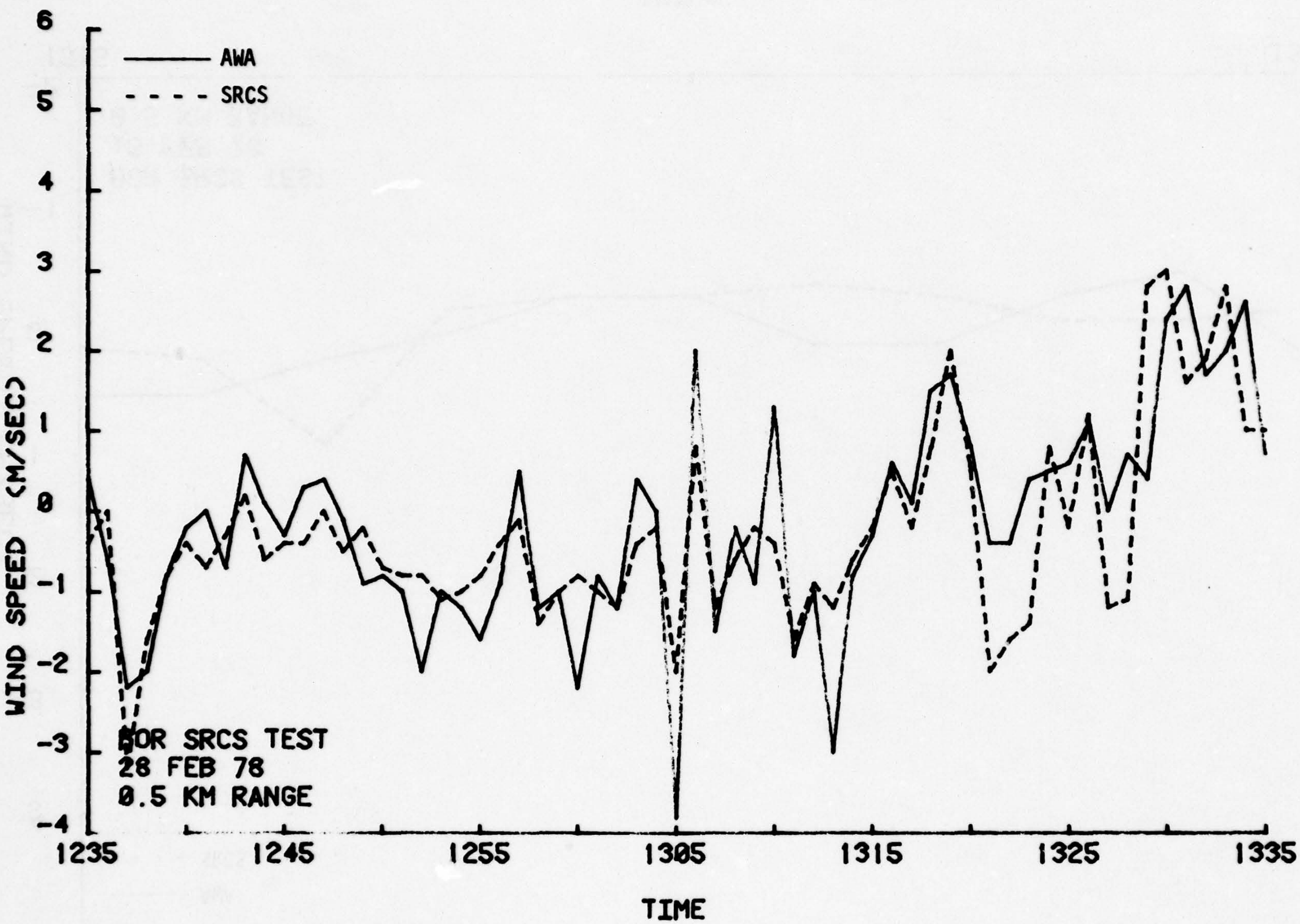


Figure B-6. SRCS wind comparison plot, 28 Feb 78, 0.5 km range, 1235-1335 hours.

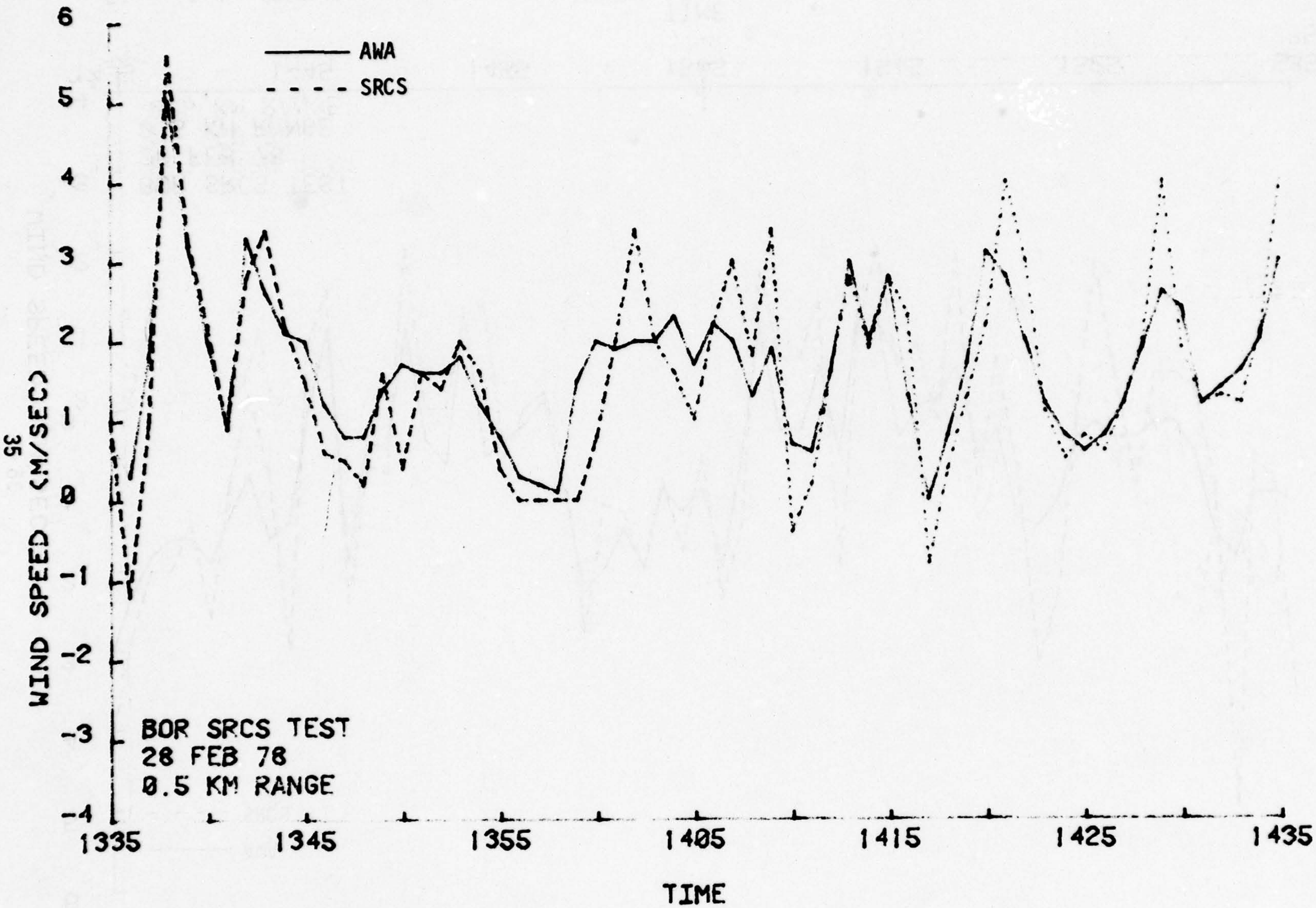


Figure B-7. SRCS wind comparison plot, 28 Feb 78, 0.5 km range. 1335-1435 hours.

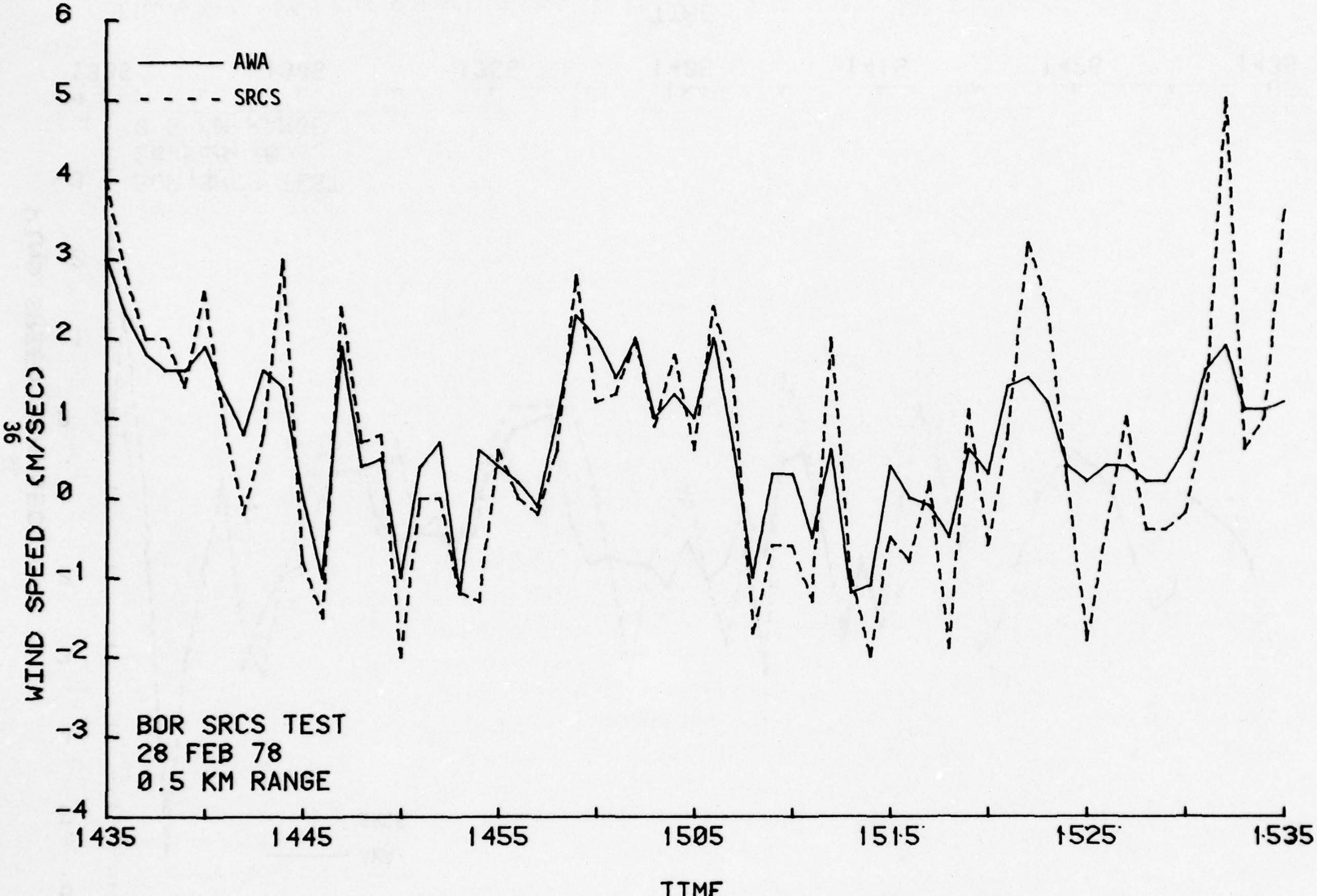


Figure B-8. SRCS wind comparison plot, 28 Feb 78, 0.5 km range, 1435-1535 hours.

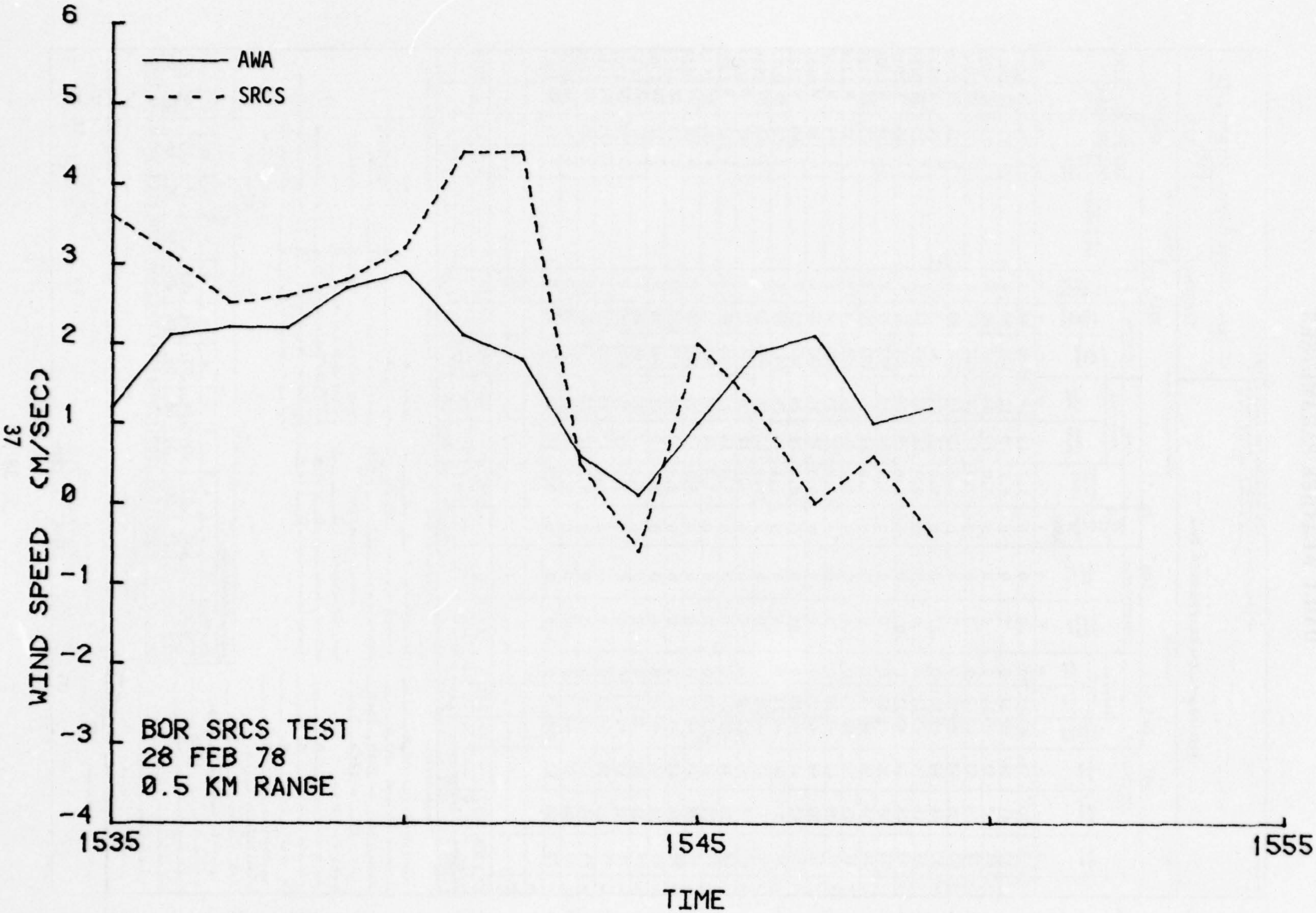


Figure B-9. SRCS wind comparison plot, 28 Feb 78, 0.5 km range, 1535-1555 hours.

APPENDIX C

DAILY WEATHER PARAMETERS

WS FORM F-6 (9-74)

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

PRELIMINARY LOCAL CLIMATOLOGICAL DATA

STATION: El Paso, International Airport, TX
MONTH: FEBRUARY
YEAR: 1978

LATITUDE: 31° 48′ N
LONGITUDE: 106° 24′ W
GROUND ELEVATION (ft): 3918 FT
STANDARD TIME: MTN

DAY	TEMPERATURE °F: MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	DEGREE DAYS (Base 65°): HEATING	COOLING	PRECIPITATION (In.): TOTAL (Water equivalent)	SNOWFALL, ICE PELLETS	SNOW, ICE PELLETS OR ICE ON GROUND AT 5AM	WIND: AVERAGE SPEED (m.p.h.)	FASTEST MILE: SPEED (m.p.h.)	DIRECTION	SUNSHINE: TOTAL (Hrs. and tenths)	PERCENT OF POSSIBLE	SKY COVER SUNRISE TO SUNSET (Tenths)	WEATHER OCCURRENCES	SKY MID TO MID	PK MPH	GUST DIRT	TIME
1	2	3	4	5	6a	6b	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	67	39	53	+7	12	0	0	0	0	5.7	13	28	626	98	3		1	24	W	1249
2	55	41	48	+2	17	0	T	0	0	5.8	9	10	571	89	4		4	17	NE	0803
3	64	37	51	+5	14	0	0	0	0	5.0	10	02	644	100	0		1	15	NE	1203
4	72	33	53	+7	12	0	0	0	0	7.2	17	04	627	97	4		4	23	NE	1649
5	63	35	49	+2	16	0	0	0	0	4.5	13	13	446	69	9		8	16	SE	1639
6	53	44	49	+2	16	0	.27	0	0	6.2	15	22	36	6	10	1	8	24	W	1833
7	62	46	54	+7	11	0	0	0	0	9.8	18	22	545	84	5		5	25	SW	0438
8	62	46	54	+7	11	0	.03	0	0	14.6	29	26	331	51	6		5	45	W	2019
9	63	37	50	+3	15	0	0	0	0	6.0	22	28	632	97	2		1	28	W	0004
10	74	37	56	+8	9	0	0	0	0	4.8	12	14	593	90	3		3	23	SW	1354
11	57	43	50	+2	15	0	.04	0	0	9.6	24	25	605	9	10		7	35	W	1248
12	51	39	45	-3	20	0	0	0	0	11.7	22	25	430	65	5		7	43	W	1418
13	53	39	46	-2	19	0	0	0	0	10.5	25	25	593	90	6		6	39	W	0457
14	53	41	47	-1	18	0	.02	0	0	10.4	21	26	367	55	7		7	40	W	2122
15	54	33	44	-4	21	0	0	0	0	7.1	21	26	593	89	2		3	29	SW	0012
16	55	35	45	-4	20	0	0	0	0	14.7	28	30	466	70	5		3	44	NW	1956
17	45	25	35	-13	30	0	0	0	0	3.2	12	01	474	71	7		4	17	N	0057
18	48	28	38	-11	27	0	0	0	0	3.4	14	25	645	96	2		1	17	N	1306
19	47	27	37	-12	28	0	0	0	0	7.6	14	02	556	83	5		4	30	NE	1411
20	57	28	43	-6	22	0	0	0	0	6.6	13	23	673	100	0		0	21	SW	0254
21	58	28	43	-7	22	0	0	0	0	3.9	7	06	675	100	0		0	13	SE	1457
22	63	29	46	-4	19	0	0	0	0	3.1	9	01	649	96	9		7	12	SW	1306
23	68	31	50	0	15	0	0	0	0	3.1	7	20	666	98	6		4	15	NE	0217
24	71	32	52	+2	13	0	0	0	0	7.7	18	29	680	100	0		0	29	NW	1702
25	73	35	54	+4	11	0	0	0	0	6.0	13	23	682	100	1		0	23	SW	1614
26	74	44	59	+8	6	0	T	0	0	8.2	17	22	3	0	10		9	30	SW	2236
27	65	50	58	+7	7	0	.06	0	0	9.9	18	24	234	34	8		8	31	SW	0002
28	73	50	62	+11	3	0	.05	0	0	9.9	16	22	310	45	8	1	9	29	SW	1340
29																				
30																				
31																				
SUM	1700	1032	—	—	449	0	.47	0	—	206.2	—	—	13807	---	137	—	119	45	W	2019
AVG	60.7	36.9	—	—	—	—	—	—	—	7.4	FASTEST	DIRECTION	POSSIBLE	%		—				
										MISC. →	29	26	18583	74	4.9	—	4.3			

TEMPERATURE DATA

AVERAGE MONTHLY 48.8
DEPARTURE FROM NORMAL +0.4
HIGHEST 74 ON 10th, 26th
LOWEST 25 ON 17th
NUMBER OF DAYS WITH –
MAX. 32° OR BELOW 0
MAX. 90° OR ABOVE 0
MIN. 32° OR BELOW 8
MIN. 0° OR BELOW 0
HEATING DEGREE DAYS (Base 65°)
TOTAL THIS MONTH 449
DEPARTURE FROM NORMAL -16
SEASONAL TOTAL 1908
DEPARTURE FROM NORMAL -353
COOLING DEGREE DAYS (Base 65°)
TOTAL THIS MONTH 0
DEPARTURE FROM NORMAL 0
SEASONAL TOTAL 0
DEPARTURE FROM NORMAL 0

PRECIPITATION DATA

TOTAL FOR THE MONTH .47 IN.
DEPARTURE FROM NORMAL +.05 IN.
GREATEST IN 24 HRS .27 ON 6th
SNOWFALL, ICE PELLETS
TOTAL FOR THE MONTH 0 IN.
GREATEST IN 24 HRS 0 ON –
GREATEST DEPTH ON GROUND 0 ON –

WEATHER

NUMBER OF DAYS –
CLEAR (Scale 0–3) 10
PARTLY CLOUDY (Scale 4–7) 11
CLOUDY (Scale 8–10) 7
WITH 0.01 INCH OR MORE PRECIP. 6
WITH 0.10 INCH OR MORE PRECIP. 1
WITH 0.50 INCH OR MORE PRECIP. 0
WITH 1.00 INCH OR MORE PRECIP. 0

SYMBOLS USED IN COLUMN 16

1 = FOG
2 = FOG WITH VISIBILITY ¼ MILE OR LESS
3 = THUNDER
4 = ICE PELLETS
5 = HAIL
6 = GLAZE OR RIME
7 = DUSTSTORM OR SANDSTORM
8 = SMOKE OR HAZE
9 = BLOWING SNOW
X = TORNADO

MAXIMUM PRECIPITATION												
Δt (Minutes)	5	10	15	20	30	45	60	80	100	120	150	180
PRECIPITATION (Inches)	.02	.03	.04	.04	.05	.06	.08	.10	.11	.14	.16	.20
ENDED DATE	27	06	06	06	06	06	06	06	06	06	06	06
TIME	2312	1200	1200	1200	1200	1200	1200	1220	1220	1200	1200	1300

BAROMETRIC PRESSURE
(Climatological station elevation)
[illegible] FT. M.S.L.
MONTHLY AVERAGE STATION IN.
HIGHEST SEA-LEVEL 30.40 IN. ON 21st
LOWEST SEA-LEVEL 29.46 IN. ON 11th

WS FORM F-6
(9-74)

U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE

PRELIMINARY LOCAL CLIMATOLOGICAL DATA

STATION: El Paso, International Airport, TX

MONTH: MARCH | YEAR: 1978

LATITUDE: 31° 48' N | LONGITUDE: 106° 24' W | GROUND ELEVATION (ft): 3918 FT | STANDARD TIME: MTN

DAY	TEMPERATURE °F MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	DEGREE DAYS (Base 65°) HEATING	COOLING	PRECIPITATION (In.) TOTAL (Water equivalent)	SNOWFALL, ICE PELLETS	SNOW, ICE PELLETS OR ICE ON GROUND AT 5AM	WIND AVERAGE SPEED (m.p.h.)	FASTEST MILE SPEED (m.p.h.)	DIRECTION	SUNSHINE TOTAL (Hrs. and tenths)	PERCENT OF POSSIBLE	SKY COVER SUNRISE TO SUNSET (Tenths)	WEATHER OCCURRENCES	SKY MID TO MID	PK MPH	GUST DIRT	TIME
1	2	3	4	5	6a	6b	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	68	52	60	+9	5	0	.07	0	0	12.2	30	25	153	22	9		8	49	W	2054
2	70	52	61	+10	4	0	T	0	0	12.8	30	23	330	48	8		7	41	SW	0156
3	70	52	61	+10	4	0	0	0	0	18.5	29	28	601	87	5		4	41	SW	1031
4	67	33	50	-2	15	0	0	0	0	7.8	14	20	667	96	4		2	18	W	0348
5	77	51	64	+12	1	0	T	0	0	14.3	29	26	528	76	8		6	49	SW	2302
6	65	47	56	+4	9	0	T	T*	0	13.4	23	23	483	69	8	5	7	37	SW	0113
7	55	35	45	-7	20	0	T	0	0	6.0	27	28	285	41	7		5	30	W	0001
8	69	30	50	-2	15	0	0	0	0	6.0	15	24	704	100	0		0	21	SW	1021
9	77	37	57	+4	8	0	0	0	0	7.0	15	23	684	97	2		2	23	SW	0133
10	68	47	58	+5	7	0	0	0	0	18.6	35	26	666	94	3		2	62	SW	1258
11	66	44	55	+2	10	0	0	0	0	10.3	21	29	710	100	0		0	32	W	0016
12	65	35	50	-3	15	0	T	0	0	12.4	29	26	410	58	6		5	46	SW	1807
13	59	42	51	-3	14	0	0	0	0	17.2	25	27	540	76	4		4	40	W	2154
14	65	40	53	-1	12	0	0	0	0	15.1	23	27	716	100	0		0	35	W	1925
15																				
16																				
17																				
18																				
19																				
20																				
21																				
22																				
23																				
24																				
25																				
26																				
27																				
28																				
29																				
30																				
31																				
SUM																				
AVG											FASTEST	DIRECTION	POSSIBLE	%						
										MISC.										

TEMPERATURE DATA	PRECIPITATION DATA	WEATHER	SYMBOLS USED IN COLUMN 16
AVERAGE MONTHLY ____	TOTAL FOR THE MONTH ____ IN	NUMBER OF DAYS -	1 = FOG
DEPARTURE FROM NORMAL ____	DEPARTURE FROM NORMAL ____ IN.	CLEAR (Scale 0-3) ____	2 = FOG WITH VISIBILITY ¼ MILE OR LESS
HIGHEST ____ ON ____	GREATEST IN 24 HRS. ____ ON ____	PARTLY CLOUDY (Scale 4-7) ____	3 = THUNDER
LOWEST ____ ON ____	SNOWFALL, ICE PELLETS	CLOUDY (Scale 8-10) ____	4 = ICE PELLETS
NUMBER OF DAYS WITH -	TOTAL FOR THE MONTH ____ IN.	WITH 0.01 INCH OR MORE PRECIP. ____	5 = HAIL
MAX. 32° OR BELOW ____	GREATEST IN 24 HRS ____ ON ____	WITH 0.10 INCH OR MORE PRECIP. ____	6 = GLAZE OR RIME
MAX. 90° OR ABOVE ____	GREATEST DEPTH ON GROUND ____ ON ____	WITH 0.50 INCH OR MORE PRECIP. ____	7 = DUSTSTORM OR SANDSTORM
MIN. 32° OR BELOW ____		WITH 1.00 INCH OR MORE PRECIP. ____	8 = SMOKE OR HAZE
MIN. 0° OR BELOW ____			9 = BLOWING SNOW
HEATING DEGREE DAYS (Base 65°)			X = TORNADO
TOTAL THIS MONTH ____			
DEPARTURE FROM NORMAL ____			
SEASONAL TOTAL ____			
DEPARTURE FROM NORMAL ____			
COOLING DEGREE DAYS (Base 65°)			
TOTAL THIS MONTH ____			
DEPARTURE FROM NORMAL ____			
SEASONAL TOTAL ____			
DEPARTURE FROM NORMAL ____			

MAXIMUM PRECIPITATION

Δt (Minutes)	5	10	15	20	30	45	60	80	100	120	150	180
PRECIPITATION (Inches)												
ENDED DATE												
TIME												

BAROMETRIC PRESSURE
(Climatological station elevation)

(Hpc) ____ FT. M.S.L.
MONTHLY AVERAGE STATION ____ IN.
HIGHEST SEA-LEVEL ____ IN. ON ____
LOWEST SEA-LEVEL ____ IN. ON ____

*T-Hail

APPENDIX D. FORTRAN IV DATA PLOT PROGRAMS

```
$WLTMC T=00004 IS ON CR00002 USING 00020 BLKS R=0146

FTN4,L
      PROGRAM WLTMC,3
C*******************************************************
C     WLTMC IS USED TO LOAD COMMON WITH THE DESIRED
C     PARAMETERS FOR MAG TAPE ANALYSIS WITH WLTMG.
C*******************************************************
      COMMON F,S(22),IT(6)
      COMMON A7(4,4),B7(4),XP7(4),NA7,NS7(4),SB7,BA7(4)
      COMMON A6(5,5),B6(5),XP6(5),NA6,NS6(5),SB6,BA6(5)
      COMMON A5(5,5),B5(5),XP5(5),NA5,NS5(5),SB5,BA5(5)
      COMMON A4(6,6),B4(6),XP4(6),NA4,NS4(6),SB4,BA4(6)
      COMMON A3(8,8),B3(8),XP3(8),NA3,NS3(8),SB3,BA3(8)
      COMMON A2(11,11),B2(11),XP2(11),NA2,NS2(11),SB2,BA2(11)
      COMMON P,NB,MN,IS,MS,IARRY
      COMMON IW1,IW2,IW3,IW4,IW5,IWZ
      COMMON WT(21)
      COMMON XC,YC,SN,SX,SY,SXX,SYX,DA,DS
      DIMENSION IP(5)
      CALL RMPAR(IP)
      LU1=IP(1)
      LU2=IP(2)
      LU3=IP(3)
      LP=IP(4)
      IF(LU1.EQ.0)LU1=1
      IF(LU2.EQ.0)LU2=1
      IF(LU3.EQ.0)LU3=1
      IF(LP.EQ.0)LP=1
C     ZERO OUT ARRAYS
      DO 1 I=1,11
      DO 1 J=1,11
      A2(I,J)=0.0
      B2(I)=0.0
      XP2(I)=0.0
      NS2(I)=0
      BA2(I)=0.0
      IF(I.GT.8.OR.J.GT.8)GO TO 1
      A3(I,J)=0.0
      B3(I)=0.0
      XP3(I)=0.0
      NS3(I)=0
      BA3(I)=0.0
      IF(I.GT.6.OR.J.GT.6)GO TO 1
      A4(I,J)=0.0
      B4(I)=0.0
      XP4(I)=0.0
      NS4(I)=0
      BA4(I)=0.0
      IF(I.GT.5.OR.J.GT.5)GO TO 1
      A5(I,J)=0.0
      B5(I)=0.0
      XP5(I)=0.0
      NS5(I)=0
      BA5(I)=0.0
      A6(I,J)=0.0
      B6(I)=0.0
      XP6(I)=0.0
      NS6(I)=0
      BA6(I)=0.0
```

```
      IF(I.GT.4.OR.J.GT.4)GO TO 1
      A7(I,J)=0.0
      B7(I)=0.0
      XP7(I)=0.0
      NS7(I)=0
      BA7(I)=0.0
1     CONTINUE
      NA7=0
      SB7=0.0
      NA6=0
      SB6=0.0
      NA5=0
      SB5=0.0
      NA4=0
      SB4=0.0
      NA3=0
      SB3=0.0
      NA2=0
      SB2=0.0
C     ZERO SUMS FOR WLTM1
      P=0.0
      DA=0.0
      DS=0.0
      SN=0.0
      SX=0.0
      SY=0.0
      SYX=0.0
      SXX=0.0
C     GET CALIBRATION AND WEIGHTS FOR WLTM1.
      IF(LP.NE.1)WRITE(LP,199)
199   FORMAT(1H1,2X,"CALIBRATION FACTORS FOR REAL TIME ANALYSIS"/
     *1H0,2X,"WEIGHTS FOR ANEMOMETERS ARE"/)
      IF(LU1.EQ.1)WRITE(1,99)
99    FORMAT("INPUT WEIGHTS"/)
      DO 2 I=1,21
      IF(LU1.EQ.1)WRITE(1,98)I
      READ(LU1,*)WT(I)
      IF(LP.NE.1)WRITE(LP,198)I,WT(I)
2     CONTINUE
98    FORMAT(I2,3X,"_")
198   FORMAT(1H ,I2,F10.5)
      IF(LU2.EQ.1)WRITE(1,97)
97    FORMAT("INPUT XCAL, YCAL",3X,"_")
      READ(LU2,*)XC,YC
      IF(LP.NE.1)WRITE(LP,197)XC,YC
197   FORMAT(1H0,2X,"XCAL,YCAL ARE",F10.7,",",F10.7)
      IF(LU2.EQ.1)WRITE(1,96)
96    FORMAT("INPUT # OF SENSOR",3X,"_")
      READ(LU2,*)IS
      IF(LP.NE.1)WRITE(LP,196)IS
196   FORMAT(1H0,2X,"SENSOR #",I4)
      IF(LU2.EQ.1)WRITE(1,95)
95    FORMAT("INPUT TIME INTERVAL IN MINUTES FOR WLTM3",3X,"_")
      READ(LU2,*)MN
      IF(LP.NE.1)WRITE(LP,195)MN
195   FORMAT(1H0,2X,"LEAST SQUARES READOUT EVERY".I3," MINUTES")
C     DETERMINE IF .5K OR 2K WANTED.
      IF(LU2.EQ.1)WRITE(1,93)
93    FORMAT("ENTER 0 FOR .5K OR 2 FOR 2K",3X,"_")
      READ(LU2,*)IARRY
```

```
      IF(IARRY.EQ.0)WRITE(LP,193)
      IF(IARRY.EQ.2)WRITE(LP,200)
193   FORMAT(1H0,2X,"ANALYSIS FOR THE 1/2 K ARRAY")
200   FORMAT(1H0,2X,"ANALYSIS FOR THE   2 K ARRAY")
      IF(LU3.EQ.1)WRITE(1,92)
92    FORMAT("INPUT 0 OR 1 FOR SUBS DESIRED"/
     *"OR TO DESIGNATE OTHER PARAMETERS")
      IF(LP.NE.1)WRITE(LP,192)
192   FORMAT(1H0,2X,"SUBS DESIRED OR OTHER PARAMETERS")
91    FORMAT("IW1",3X,"_")
90    FORMAT("IW2",3X,"_")
89    FORMAT("IW3",3X,"_")
88    FORMAT("IW4",3X,"_")
87    FORMAT("IW5",3X,"_")
191   FORMAT(1H ,2X,"IW1",I5)
190   FORMAT(1H ,2X,"IW2",I5)
189   FORMAT(1H ,2X,"IW3",I5)
188   FORMAT(1H ,2X,"IW4",I5)
187   FORMAT(1H ,2X,"IW5",I5)
      IF(LU3.EQ.1)WRITE(1,91)
      READ(LU3,*)IW1
      IF(LP.NE.1)WRITE(LP,191)IW1
      IF(LU3.EQ.1)WRITE(1,90)
      READ(LU3,*)IW2
      IF(LP.NE.1)WRITE(LP,190)IW2
      IF(LU3.EQ.1)WRITE(1,89)
      READ(LU3,*)IW3
      IF(LP.NE.1)WRITE(LP,189)IW3
      IF(LU3.EQ.1)WRITE(1,88)
      READ(LU3,*)IW4
      IF(LP.NE.1)WRITE(LP,188)IW4
      IF(LU3.EQ.1)WRITE(1,87)
      READ(LU3,*)IW5
      IF(LP.NE.1)WRITE(LP,187)IW5
      WRITE(1,85)
85    FORMAT("ENTER FILE # ON TAPE",3X,"_")
      READ(1,*)IWZ
      IF(LP.NE.1)WRITE(LP,185)IWZ
185   FORMAT(1H0,2X,"TAPE FILE #",I2)
      WRITE(1,84)
84    FORMAT("INPUT TIME INTERVAL IN SECONDS",3X,"_")
      READ(1,*)MS
      IF(LP.NE.1)WRITE(LP,184)MS
184   FORMAT(1H0,2X,"AVERAGING TIME IS",I3," SECONDS")
      WRITE(1,83)
83    FORMAT(/"THAT'S ALL, THANKS")
      STOP
      END
      END$
```

$WLTMG T=00004 IS ON CR00002 USING 00014 BLKS R=0114

```
FTN4,L
      PROGRAM WLTMG,3
C*************************************************
      COMMON F,S(22),IT(6)
      COMMON A7(4,4),B7(4),XP7(4),NA7,NS7(4),SB7,BA7(4)
      COMMON A6(5,5),B6(5),XP6(5),NA6,NS6(5),SB6,BA6(5)
      COMMON A5(5,5),B5(5),XP5(5),NA5,NS5(5),SB5,BA5(5)
      COMMON A4(6,6),B4(6),XP4(6),NA4,NS4(6),SB4,BA4(6)
      COMMON A3(8,8),B3(8),XP3(8),NA3,NS3(8),SB3,BA3(8)
      COMMON A2(11,11),B2(11),XP2(11),NA2,NS2(11),SB2,BA2(11)
      COMMON P,NB,MN,IS,MS,IARRY
      COMMON IW1,IW2,IW3,IW4,IW5,IWZ
      COMMON WT(21)
      COMMON XC,YC,SN,SX,SY,SXX,SYX,DA,DS
      DIMENSION ITM(5),IDT(94),IDATA(100)
      DIMENSION ST(37)
      DIMENSION NW4(3),MON(2)
      EQUIVALENCE (ITM(1),IDATA(1)),(IY,IDATA(6)),
     *(IDT(1),IDATA(7))
      DATA NW4/2HWL,2HTM,2H4 /
1     CONTINUE
      CALL EXEC(3,611B)
      CALL EXEC(13,9,ISTAT)
      ISTT=IAND(ISTAT,1B)
      IF(ISTT.NE.0)GO TO 1
      ISTT=IAND(ISTAT,200B)
      IF(ISTT.EQ.0)GO TO 2
      CALL EXEC(3,311B)
2     CONTINUE
      CALL EXEC(1,111B,IDATA,100)
      CALL EXEC(3,211B)
      SEC=MS
      IF(MS.EQ.0)SEC=0.5
      IDAY=ITM(5)
      LIT=ITM(3)
      CALL DATE(IDAY,MON,IY)
      WRITE(6,99)IS,SEC,IW3,ITM(4),ITM(3),ITM(2),IDAY,MON,IY
99    FORMAT(1H1,"ANALYSIS OF CH #",I3,", WITH",F5.1," SEC AVG."/
     *1H ,"WITH SLIDE FACTOR OF",I3/
     *1H ,"FOR DATA BEGINNING",I3,":",I2,":",I2," ON",I3,1X,2A2,I4)
      CALL EXEC(11,ITM,IY)
      IDAY=ITM(5)
      CALL DATE(IDAY,MON,IY)
      WRITE(6,98)ITM(4),ITM(3),ITM(2),IDAY,MON,IY
98    FORMAT(1H ,"ANALYSIS STARTED",I3,":",I2,":",I2," ON",I3,1X,2A2,I
      IF(IW1.EQ.0)GO TO 3
      CALL WLTM5
3     CONTINUE
      DO 67 IRPT=1,32767
      F=0.0
      DO 4 I=1,37
4     ST(I)=0.0
      DO 6 I=1,200
      CALL EXEC(1,111B,IDATA,100)
      CALL EXEC(13,9,ISTAT)
      ISTAT=IAND(ISTAT,200B)
      IF(ISTAT.NE.0)GO TO 68
      F=F+1.
```

```
      DO 5 J=1,36
5     ST(J)=ST(J)+FLOAT(IDT(J))
      ST(37)=ST(37)+FLOAT(IDT(IS))
      IF(MS.EQ.0)GO TO 7
      ISTAT=MOD(ITM(2),MS)
      IF(ISTAT.NE.0)GO TO 6
      IF(ITM(1).GE.50)GO TO 6
      GO TO 7
6     CONTINUE
7     CONTINUE
      DO 8 J=1,6
8     IT(J)=IDATA(J)
      IF(IT(3).EQ.LIT)GO TO 9
      ISWTM=IT(3)+IT(4)*1000B
      CALL PSSW(ISWTM)
      LIT=IT(3)
9     CONTINUE
C     CHECK FOR .5K OR 2K RANGE.
      IF(IARRY.LE.1)GO TO 12
      K=0
      DO 10 I=1,21,4
      K=K+1
10    S(K)=ST(I)*XC/F
      DO 11 I=22,36
      K=K+1
11    S(K)=ST(I)*XC/F
      GO TO 14
12    CONTINUE
      DO 13 I=1,21
13    S(I)=ST(I)*XC/F
14    CONTINUE
      S(22)=ST(37)*YC/F
C     SUM ALL POINTS.
      P=P+F
      IF(IW1.EQ.0)GO TO 15
      CALL WLTM1
15    CONTINUE
      CALL WLTM2
      IF(MN.EQ.0)GO TO 67
      MO=MOD(IT(3),MN)
      IF(MO.NE.0)GO TO 67
      IF(IT(2).NE.0)GO TO 67
      IF(IT(1).GE.50)GO TO 67
      CALL WLTM3
67    CONTINUE
68    CONTINUE
      IF(IW2.LE.1)GO TO 16
      CALL EXEC(3,211B)
      CALL EXEC(3,1411B)
      GO TO 17
16    CALL EXEC(3,411B)
17    CONTINUE
      IF(IW4.NE.1)GO TO 18
      CALL WLTM5
18    CONTINUE
      CALL WLTM3
      CALL EXEC(10,NW4)
69    CONTINUE
      STOP
      END

      END$
```

```
SWLTM1 T=00004 IS ON CR00002 USING 00006 BLKS R=0043

FTN4,L
      SUBROUTINE WLTM1
C*****************************************************************
C     WLTM1 IS USED TO MAKE THE CORRELATION PLOT OF A SENSOR
C     VERSUS A WEIGHTED AVERAGE OF 21 ANEMOMETERS FROM DATA
C     FROM MAG TAPE.
C**************************************************
      COMMON F,S(22),IT(6)
      COMMON A7(4,4),B7(4),XP7(4),NA7,NS7(4),SB7,BA7(4)
      COMMON A6(5,5),B6(5),XP6(5),NA6,NS6(5),SB6,BA6(5)
      COMMON A5(5,5),B5(5),XP5(5),NA5,NS5(5),SB5,BA5(5)
      COMMON A4(6,6),B4(6),XP4(6),NA4,NS4(6),SB4,BA4(6)
      COMMON A3(8,8),B3(8),XP3(8),NA3,NS3(8),SB3,BA3(8)
      COMMON A2(11,11),B2(11),XP2(11),NA2,NS2(11),SB2,BA2(11)
      COMMON P,NB,MN,IS,MS,IARRY
      COMMON IW1,IW2,IW3,IW4,IW5,IWZ
      COMMON WT(21)
      COMMON XC,YC,SN,SX,SY,SXX,SYX,DA,DS
      CALL PLTLU(10)
      CALL SFACT(15.,10.)
      Y=S(22)
      X=0.0
      DO 1 I=1,21
1     X=X+S(I)*WT(I)
      SN=SN+1.0
      D=(Y-X)/10.
      DA=DA+D
      DS=DS+D*D
      SX=SX+X
      SY=SY+Y
      SYX=SYX+Y*X
      SXX=SXX+X*X
      Z=ABS(X)
      IF(Z.GE.4.75)X=4.75*X/Z
      X=X+5.0
      Z=ABS(Y)
      IF(Z.GE.4.75)Y=4.75*Y/Z
      Y=Y+5.0
      CALL PLOT(X,Y,3)
      CALL PLOT(X,Y,2)
      CALL PLOT(X,Y,3)
69    CONTINUE
      RETURN
      END
      END$
```

```
SWLTM2 T=00004 IS ON CR00002 USING 00021 BLKS R=0205

FTN4,L
      SUBROUTINE WLTM2
C************************************************************
C     WLTM2 IS USED TO LOAD THE ARRAYS FOR THE LEAST SQUARES
C     CORRELATION FIT TO WEIGHTING FACTORS FOR DATA FROM MAG
C     TAPE.
C**************************************************
      COMMON F,S(22),IT(6)
      COMMON A7(4,4),B7(4),XP7(4),NA7,NS7(4),SB7,BA7(4)
      COMMON A6(5,5),B6(5),XP6(5),NA6,NS6(5),SB6,BA6(5)
      COMMON A5(5,5),B5(5),XP5(5),NA5,NS5(5),SB5,BA5(5)
      COMMON A4(6,6),B4(6),XP4(6),NA4,NS4(6),SB4,BA4(6)
      COMMON A3(8,8),B3(8),XP3(8),NA3,NS3(8),SB3,BA3(8)
      COMMON A2(11,11),B2(11),XP2(11),NA2,NS2(11),SB2,BA2(11)
      COMMON P,NB,MN,IS,MS,IARRY
      COMMON IW1,IW2,IW3,IW4,IW5,IWZ
      COMMON WT(21)
      COMMON XC,YC,SN,SX,SY,SXX,SYX,DA,DS
      DIMENSION D(11),NS(11),XP(11)
      IF(IW2.GT.1.)GO TO 68
      NB=0
      NA7=0
      NA6=0
      NA5=0
      NA4=0
      NA3=0
      NA2=0
      DO 67 INOW=1,IW5
      GO TO (1,2,3,4,5,6),INOW
1     JCNT=4
      KCNT=7
      GO TO 7
2     JCNT=5
      KCNT=6
      GO TO 7
3     JCNT=5
      KCNT=5
      GO TO 7
4     JCNT=6
      KCNT=4
      GO TO 7
5     JCNT=8
      KCNT=3
      GO TO 7
6     JCNT=11
      KCNT=2
7     CONTINUE
      NA=1
      DO 9 J=1,JCNT
      NS(NA)=0
      XP(NA)=0.0
      DO 8 K=1,KCNT
      L=(J-1)*KCNT+K+IW3
      IF(L.LT.1.OR.L.GT.21)GO TO 8
      IFLAG=L
      NS(NA)=NS(NA)+1
      XP(NA)=XP(NA)+FLOAT(L)
8     CONTINUE
```

```
      IF(NS(NA).EQ.0)GO TO 9
      ADEC=NS(NA)
      XP(NA)=XP(NA)/ADEC
      NA=NA+1
9     CONTINUE
      NA=NA-1
      GO TO (10,12,14,16,18,20),INOW
10    NA7=NA
      IF(IFLAG.LT.21)NA7=0
      NB=NB+NA7
      DO 11 J=1,JCNT
      XP7(J)=XP(J)
11    NS7(J)=NS(J)
      GO TO 67
12    NA6=NA
      IF(IW3.LE.-6)IFLAG=0
      IF(IFLAG.LT.21)NA6=0
      NB=NB+NA6
      DO 13 J=1,JCNT
      XP6(J)=XP(J)
13    NS6(J)=NS(J)
      GO TO 67
14    NA5=NA
      IF(IFLAG.LT.21)NA5=0
      NB=NB+NA5
      DO 15 J=1,JCNT
      XP5(J)=XP(J)
15    NS5(J)=NS(J)
      GO TO 67
16    NA4=NA
      IF(IFLAG.LT.21)NA4=0
      NB=NB+NA4
      DO 17 J=1,JCNT
      XP4(J)=XP(J)
17    NS4(J)=NS(J)
      GO TO 67
18    NA3=NA
      IF(IW3.LE.-3)IFLAG=0
      IF(IFLAG.LT.21)NA3=0
      NB=NB+NA3
      DO 19 J=1,JCNT
      XP3(J)=XP(J)
19    NS3(J)=NS(J)
      GO TO 67
20    NA2=NA
      IF(IFLAG.LT.21)NA2=0
      NB=NB+NA2
      DO 21 J=1,JCNT
      XP2(J)=XP(J)
21    NS2(J)=NS(J)
67    CONTINUE
      IW2=2
68    CONTINUE
      IF(NA7.LE.0)GO TO 25
      L=0
      DO 24 J=1,NA7
      KJ=NS7(J)
      D(J)=0.0
      DO 22 K=1,KJ
      L=L+1
```

```
      D(J)=D(J)+S(L)
   22 CONTINUE
      ADEC=KJ
      D(J)=D(J)/ADEC
      B7(J)=B7(J)+S(22)*D(J)
      DO 23 I=1,J
   23 A7(I,J)=A7(I,J)+D(I)*D(J)
   24 CONTINUE
   25 CONTINUE
      IF(NA6.LE.0)GO TO 29
      L=0
      DO 28 J=1,NA6
      D(J)=0.0
      KJ=NS6(J)
      DO 26 K=1,KJ
      L=L+1
      D(J)=D(J)+S(L)
   26 CONTINUE
      ADEC=KJ
      D(J)=D(J)/ADEC
      B6(J)=B6(J)+S(22)*D(J)
      DO 27 I=1,J
   27 A6(I,J)=A6(I,J)+D(I)*D(J)
   28 CONTINUE
   29 CONTINUE
      IF(NA5.LE.0)GO TO 33
      L=0
      DO 32 J=1,NA5
      D(J)=0.0
      KJ=NS5(J)
      DO 30 K=1,KJ
      L=L+1
      D(J)=D(J)+S(L)
   30 CONTINUE
      ADEC=KJ
      D(J)=D(J)/ADEC
      B5(J)=B5(J)+S(22)*D(J)
      DO 31 I=1,J
   31 A5(I,J)=A5(I,J)+D(I)*D(J)
   32 CONTINUE
   33 CONTINUE
      IF(NA4.LE.0)GO TO 37
      L=0
      DO 36 J=1,NA4
      D(J)=0.0
      KJ=NS4(J)
      DO 34 K=1,KJ
      L=L+1
      D(J)=D(J)+S(L)
   34 CONTINUE
      ADEC=KJ
      D(J)=D(J)/ADEC
      B4(J)=B4(J)+S(22)*D(J)
      DO 35 I=1,J
   35 A4(I,J)=A4(I,J)+D(I)*D(J)
   36 CONTINUE
   37 CONTINUE
      IF(NA3.LE.0)GO TO 41
      L=0
      DO 40 J=1,NA3
```

```
      D(J)=0.0
      KJ=NS3(J)
      DO 38 K=1,KJ
      L=L+1
      D(J)=D(J)+S(L)
38    CONTINUE
      ADEC=KJ
      D(J)=D(J)/ADEC
      B3(J)=B3(J)+S(22)*D(J)
      DO 39 I=1,J
39    A3(I,J)=A3(I,J)+D(I)*D(J)
40    CONTINUE
41    CONTINUE
      IF(NA2.LE.0)GO TO 69
      L=0
      DO 44 J=1,NA2
      D(J)=0.0
      KJ=NS2(J)
      DO 42 K=1,KJ
      L=L+1
      D(J)=D(J)+S(L)
42    CONTINUE
      ADEC=KJ
      D(J)=D(J)/ADEC
      B2(J)=B2(J)+S(22)*D(J)
      DO 43 I=1,J
43    A2(I,J)=A2(I,J)+D(I)*D(J)
44    CONTINUE
69    CONTINUE
      RETURN
      END
      END$
```

SWLTM3 T=00004 IS ON CR00002 USING 00011 BLKS R=0091

```
FTN4,L
      SUBROUTINE WLTM3
C*******************************************************************
C     WLTM3 IS USED TO COMPUTE THE FIT FOR WEIGHTING FACTORS
C     FOR DATA FROM MAG TAPE.
C*******************************************************
      COMMON F,S(22),IT(6)
      COMMON A7(4,4),B7(4),XP7(4),NA7,NS7(4),SB7,BA7(4)
      COMMON A6(5,5),B6(5),XP6(5),NA6,NS6(5),SB6,BA6(5)
      COMMON A5(5,5),B5(5),XP5(5),NA5,NS5(5),SB5,BA5(5)
      COMMON A4(6,6),B4(6),XP4(6),NA4,NS4(6),SB4,BA4(6)
      COMMON A3(8,8),B3(8),XP3(8),NA3,NS3(8),SB3,BA3(8)
      COMMON A2(11,11),B2(11),XP2(11),NA2,NS2(11),SB2,BA2(11)
      COMMON P,NB,MN,IS,MS,IARRY
      COMMON IW1,IW2,IW3,IW4,IW5,IWZ
      COMMON WT(21)
      COMMON XC,YC,SN,SX,SY,SXX,SYX,DA,DS
      DIMENSION A(11,11)
      WRITE(6,99)IT(4),IT(3),P
99    FORMAT(1H0,"AT",I3,":",I2," WITH",F10.0," POINTS")
      DO 69 L=1,IW5
      GO TO (1,3,5,7,9,11),L
1     CONTINUE
      IF(NA7.LE.0)GO TO 69
      DO 2 J=1,NA7
      BA7(J)=B7(J)
      DO 2 I=1,J
      A(I,J)=A7(I,J)
2     A(J,I)=A7(I,J)
      NG=7
      MTS=4
      CALL W3SUB(A,B7,XP7,NA7,NS7,SB7,BA7,NG,MTS)
      IF(NG.EQ.7)GO TO 69
      NB=NB-NA7
      NA7=-1
      GO TO 69
3     CONTINUE
      IF(NA6.LE.0)GO TO 69
      DO 4 J=1,NA6
      BA6(J)=B6(J)
      DO 4 I=1,J
      A(I,J)=A6(I,J)
4     A(J,I)=A6(I,J)
      NG=6
      MTS=5
      CALL W3SUB(A,B6,XP6,NA6,NS6,SB6,BA6,NG,MTS)
      IF(NG.EQ.6)GO TO 69
      NB=NB-NA6
      NA6=-1
      GO TO 69
5     CONTINUE
      IF(NA5.LE.0)GO TO 69
      DO 6 J=1,NA5
      BA5(J)=B5(J)
      DO 6 I=1,J
      A(I,J)=A5(I,J)
6     A(J,I)=A5(I,J)
      NG=5
```

```
      MTS=5
      CALL W3SUB(A,B5,XP5,NA5,NS5,SB5,BA5,NG,MTS)
      IF(NG.EQ.5)GO TO 69
      NB=NB-NA5
      NA5=-1
      GO TO 69
7     CONTINUE
      IF(NA4.LE.0)GO TO 69
      DO 8 J=1,NA4
      BA4(J)=B4(J)
      DO 8 I=1,J
      A(I,J)=A4(I,J)
8     A(J,I)=A4(I,J)
      NG=4
      MTS=6
      CALL W3SUB(A,B4,XP4,NA4,NS4,SB4,BA4,NG,MTS)
      IF(NG.EQ.4)GO TO 69
      NB=NB-NA4
      NA4=-1
      GO TO 69
9     CONTINUE
      IF(NA3.LE.0)GO TO 69
      DO 10 J=1,NA3
      BA3(J)=B3(J)
      DO 10 I=1,J
      A(I,J)=A3(I,J)
10    A(J,I)=A3(I,J)
      NG=3
      MTS=8
      CALL W3SUB(A,B3,XP3,NA3,NS3,SB3,BA3,NG,MTS)
      IF(NG.EQ.3)GO TO 69
      NB=NB-NA3
      NA3=-1
      GO TO 69
11    CONTINUE
      IF(NA2.LE.0)GO TO 69
      DO 12 J=1,NA2
      BA2(J)=B2(J)
      DO 12 I=1,J
      A(I,J)=A2(I,J)
12    A(J,I)=A2(I,J)
      NG=2
      MTS=11
      CALL W3SUB(A,B2,XP2,NA2,NS2,SB2,BA2,NG,MTS)
      IF(NG.EQ.2)GO TO 69
      NB=NB-NA2
      NA2=-1
69    CONTINUE
      RETURN
      END
C*************************************************************
      SUBROUTINE W3SUB(A,B,XP,NA,NS,SB,BA,NG,MTS)
      DIMENSION A(11,11),B(MTS),XP(MTS),NS(MTS),BA(MTS)
      M=NA
      SB=0.0
      A11=A(1,1)
      IF(A11.EQ.0)GO TO 68
      DO 1 I=2,M
1     A(1,I)=A(I,1)/A11
      BA(1)=BA(1)/A11
```

```
      DO 5 J=2,M
      J1=J-1
      DO 3 I=J,M
      AS=0.0
      DO 2 K=1,J1
2     AS=AS+A(I,K)*A(K,J)
      A(I,J)=A(I,J)-AS
      IF(I.GT.J)A(J,I)=A(I,J)/A(J,J)
3     CONTINUE
      BS=0.0
      DO 4 K=1,J1
4     BS=BS+A(J,K)*BA(K)
      AJJ=A(J,J)
      IF(AJJ.EQ.0)GO TO 68
5     BA(J)=(BA(J)-BS)/AJJ
      M1=M-1
      DO 7 I=1,M1
      BS=0.0
      MI=M-I
      MI1=MI+1
      DO 6 J=MI1,M
6     BS=BS+A(MI,J)*BA(J)
      BA(MI)=BA(MI)-BS
7     CONTINUE
      WRITE(6,99)NG
99    FORMAT(1H0,"FOR GROUPS OF",I3)
      WRITE(6,98)(NS(J),J=1,M)
98    FORMAT(1H ,"#",11I6)
      WRITE(6,97)(XP(J),J=1,M)
97    FORMAT(1H ,"X",11F6.1)
      WRITE(6,96)(BA(J),J=1,M)
96    FORMAT(1H ,"Y",11F6.3)
      DO 8 I=1,M
      SB=SB+BA(I)
8     CONTINUE
      WRITE(6,95)SB
95    FORMAT(1H ,"SUM OF WEIGHTS =",F8.5)
      GO TO 69
68    CONTINUE
      WRITE(6,94)NG
94    FORMAT(1H0,"FOR GROUPS OF",I3," MATRIX IS SINGULAR")
      NG=-1
69    CONTINUE
      RETURN
      END
      END$
```

```
$WLTM4 T=00004 IS ON CR00002 USING 00012 BLKS R=0097

FTN4,L
      PROGRAM WLTM4,3
C***************************************************************
C     WLTM4 IS A PROGRAM WHICH NORMALIZES THE RESULTS OF WLTM3,
C     PLOTS, REPORTS, AND PUNCHES A TAPE OF THESE RESULTS.
C     IT CAN ALSO RESCHEDULE WLTMG FOR A REPEAT WITH A DIFFERENT
C     SLIDE FACTOR.
C*****************************************************
      COMMON F,S(22),IT(6)
      COMMON A7(4,4),B7(4),XP7(4),NA7,NS7(4),SB7,BA7(4)
      COMMON A6(5,5),B6(5),XP6(5),NA6,NS6(5),SB6,BA6(5)
      COMMON A5(5,5),B5(5),XP5(5),NA5,NS5(5),SB5,BA5(5)
      COMMON A4(6,6),B4(6),XP4(6),NA4,NS4(6),SB4,BA4(6)
      COMMON A3(8,8),B3(8),XP3(8),NA3,NS3(8),SB3,BA3(8)
      COMMON A2(11,11),B2(11),XP2(11),NA2,NS2(11),SB2,BA2(11)
      COMMON P,NB,MN,IS,MS,IARRY
      COMMON IW1,IW2,IW3,IW4,IW5,IWZ
      COMMON WT(21)
      COMMON XC,YC,SN,SX,SY,SXX,SYX,DA,DS
      DIMENSION NMG(3)
      DATA NMG/2HWL,2HTM,2HG /
      CALL EXEC(3,1004B)
      WRITE(4,99)NB
99    FORMAT(I3)
      DO 7 M=1,IW5
      GO TO (1,2,3,4,5,6),M
1     IF(NA7.LE.0)GO TO 7
      NG=7
      MTS=4
      CALL W4SUB(XP7,NA7,NS7,SB7,BA7,NG,MTS)
      GO TO 7
2     IF(NA6.LE.0)GO TO 7
      NG=6
      MTS=5
      CALL W4SUB(XP6,NA6,NS6,SB6,BA6,NG,MTS)
      GO TO 7
3     IF(NA5.LE.0)GO TO 7
      NG=5
      MTS=5
      CALL W4SUB(XP5,NA5,NS5,SB5,BA5,NG,MTS)
      GO TO 7
4     IF(NA4.LE.0)GO TO 7
      NG=4
      MTS=6
      CALL W4SUB(XP4,NA4,NS4,SB4,BA4,NG,MTS)
      GO TO 7
5     IF(NA3.LE.0)GO TO 7
      NG=3
      MTS=8
      CALL W4SUB(XP3,NA3,NS3,SB3,BA3,NG,MTS)
      GO TO 7
6     IF(NA2.LE.0)GO TO 7
      NG=2
      MTS=11
      CALL W4SUB(XP2,NA2,NS2,SB2,BA2,NG,MTS)
7     CONTINUE
      CALL EXEC(11,IT)
      WRITE(6,98)IT(4),IT(3),IT(2)
```

```
98    FORMAT(1H0,"ANALYSIS COMPLETED",I3,":",I2,":",I2)
      CALL EXEC(3,1004B)
      IF(IW4.EQ.1)GO TO 69
      IF(IW3.GE.0)GO TO 69
      IW3=IW3+1
      IF(IW3.EQ.0)IW4=1
      IW1=0
      IW2=1
C     ZERO OUT ARRAYS FOR WLTM2 AND 3
      DO 8 I=1,11
      DO 8 J=1,11
      A2(I,J)=0.0
      B2(I)=0.0
      NS2(I)=0
      IF(I.GT.8.OR.J.GT.8)GO TO 8
      A3(I,J)=0.0
      B3(I)=0.0
      NS3(I)=0
      IF(I.GT.6.OR.J.GT.6)GO TO 8
      A4(I,J)=0.0
      B4(I)=0.0
      NS4(I)=0
      IF(I.GT.5.OR.J.GT.5)GO TO 8
      A5(I,J)=0.0
      B5(I)=0.0
      NS5(I)=0
      A6(I,J)=0.0
      B6(I)=0.0
      NS6(I)=0
      IF(I.GT.4.OR.J.GT.4)GO TO 8
      A7(I,J)=0.0
      B7(I)=0.0
      NS7(I)=0
8     CONTINUE
      P=0.0
      CALL EXEC(10,NMG)
69    CONTINUE
      STOP
      END
C***********************************************************
      SUBROUTINE W4SUB(XP,NA,NS,SB,BA,NG,MTS)
      DIMENSION XP(MTS),NS(MTS),BA(MTS)
      CALL PLTLU(10)
      CALL SFACT(15.,10.)
      CALL LLEFT
      CALL PLOT(0.0,0.0,-1)
      CALL PLOT(3.5,1.0,3)
      SB=ABS(SB)
      DO 1 I=1,NA
      BA(I)=BA(I)/(SB*FLOAT(NS(I)))
      XV=XP(I)/2.+3.5
      YP=BA(I)*50.+1.
      IF(YP.LE.0.2)YP=0.2
      IF(YP.GE.9.8)YP=9.8
      CALL SYMB(XV,YP,0.14,NG,0.0,-1)
1     CONTINUE
      WRITE(6,99)NG
99    FORMAT(1H0,"NORMALIZED WEIGHTS FOR GROUPS OF",I3)
      WRITE(6,98)(NS(I),I=1,NA)
98    FORMAT(1H ,"#",11I6)
```

```
      WRITE(6,97)(XP(I),I=1,NA)
 97   FORMAT(1H ,"X",11F6.1)
      WRITE(6,96)(BA(I),I=1,NA)
 96   FORMAT(1H ,"Y",11F6.3)
      WRITE(4,95)(NG,NS(I),XP(I),BA(I),I=1,NA)
 95   FORMAT(I2,",",I3,",",F5.1,",",F9.5)
      CALL LLEFT
      RETURN
      END
      END$
```

SWLTM5 T=00004 IS ON CR00002 USING 00018 BLKS R=0142

```
FTN4,L
      SUBROUTINE WLTM5
C*************************************************************
C     WLTM5 IS A PROGRAM WHICH WILL REPORT THE NECESSARY
C     INFORMATION ON PLOTS AND DRAW THE GRID IF REQUIRED.
C*************************************************
      COMMON F,S(22),IT(6)
      COMMON A7(4,4),B7(4),XP7(4),NA7,NS7(4),SB7,BA7(4)
      COMMON A6(5,5),B6(5),XP6(5),NA6,NS6(5),SB6,BA6(5)
      COMMON A5(5,5),B5(5),XP5(5),NA5,NS5(5),SB5,BA5(5)
      COMMON A4(6,6),B4(6),XP4(6),NA4,NS4(6),SB4,BA4(6)
      COMMON A3(8,8),B3(8),XP3(8),NA3,NS3(8),SB3,BA3(8)
      COMMON A2(11,11),B2(11),XP2(11),NA2,NS2(11),SB2,BA2(11)
      COMMON P,NB,MN,IS,MS,IARRY
      COMMON IW1,IW2,IW3,IW4,IW5,IWZ
      COMMON WT(21)
      COMMON XC,YC,SN,SX,SY,SXX,SYX,DA,DS
      DIMENSION NA(2),NS(2),NP(2),NFS(2),NFL(2)
      DIMENSION MON(2),NCH(2),NSEC(2)
      DATA NA/2HAV,2HG=/,NS/2HSD,2HV=/
      DATA NP/2H#P,2HTS/
      DATA NFL/2HFI,2HLE/,NFS/2HFS,2H= /
      DATA NSEC/2HSE,2HC /
      DATA NCH/2HCH,2H# /
      NY=54475B
      NX=54053B
      CALL PLTLU(10)
      CALL SFACT(15.,10.)
      CALL LLEFT
      CALL PLOT(0.0,0.0,-1)
      IF(IW1.EQ.0)GO TO 5
      CALL PLOT(0.5,5.0,3)
      CALL PLOT(9.5,5.0,2)
      CALL PLOT(5.0,0.5,3)
      CALL PLOT(5.0,9.5,2)
      CALL DASH(0.5,0.5,0.5,0.5,-1)
      CALL DASH(0.5,0.5,9.5,9.5,1)
      IF(IW1.LE.1)GO TO 69
      D=SX*SX-SN*SXX
      A=(SX*SY-SN*SYX)/D
      B=(SX*SYX-SY*SXX)/D
      X=-4.0
1     CONTINUE
      Y=A*X+B
      Z=ABS(Y)
      IF(Z.LE.4.75)GO TO 2
      X=X+.5
      GO TO 1
2     CONTINUE
      X=X+5.
      Y=Y+5.
      CALL PLOT(X,Y,3)
      X=4.0
3     CONTINUE
      Y=A*X+B
      Z=ABS(Y)
      IF(Z.LE.4.75)GO TO 4
      X=X-0.5
```

```
      GO TO 3
4     CONTINUE
      X=X+5.
      Y=Y+5.
      CALL PLOT(X,Y,2)
      DATT=DA/SN
      DSTT=SQRT((DS/SN)-DATT*DATT)
5     CONTINUE
      CALL LLEFT
      CALL PLOT(0.,0.,-1)
      IDAY=IT(5)
      IYEAR=IT(6)
      CALL DATE(IDAY,MON,IYEAR)
      DAY=IDAY
      YEAR=IYEAR
      FILE=IWZ
      CHN=IS
      SEC=MS
      IF(MS.EQ.0)SEC=0.5
      FS=5./(XC*30.)
      CALL NUMB(1.0,9.0,0.14,DAY,0.0,-1)
      CALL SYMB(1.56,9.0,0.14,MON,0.0,3)
      CALL NUMB(2.25,9.0,0.14,YEAR,0.0,-1)
      CALL SYMB(1.0,8.5,0.14,NCH,0.0,3)
      CALL NUMB(1.56,8.5,0.14,CHN,0.0,-1)
      CALL NUMB(2.25,8.5,0.14,SEC,0.0,1)
      CALL SYMB(2.85,8.5,0.14,NSEC,0.0,3)
      CALL SYMB(3.40,8.5,0.14,NFL,0.0,4)
      CALL NUMB(4.10,8.5,0.14,FILE,0.0,-1)
      IF(IW1.EQ.0)GO TO 69
      CALL SYMB(1.0,8.0,0.14,NFS,0.0,3)
      CALL NUMB(999.0,999.0,0.14,FS,0.0,1)
      CALL SYMB(1.0,7.5,0.14,NY,0.0,2)
      CALL NUMB(999.0,999.0,0.14,A,0.0,3)
      CALL SYMB(999.0,999.0,0.14,NX,0.0,2)
      CALL NUMB(999.0,999.0,0.14,B,0.0,3)
      CALL SYMB(1.0,7.0,0.14,NA,0.0,4)
      CALL NUMB(999.0,999.0,0.14,DATT,0.0,3)
      CALL SYMB(3.0,7.0,0.14,NS,0.0,4)
      CALL NUMB(999.0,999.0,0.14,DSTT,0.0,3)
      CALL SYMB(1.0,6.5,0.14,NP,0.0,4)
      CALL NUMB(1.60,6.5,0.14,SN,0.0,-1)
      CALL LLEFT
69    CONTINUE
      IF(IW1.EQ.1)IW1=2
      RETURN
      END
      END$
```

DISTRIBUTION LIST

Dr. Frank D. Eaton
Geophysical Institute
University of Alaska
Fairbanks, AK 99701

Commander
US Army Aviation Center
ATTN: ATZQ-D-MA
Fort Rucker, AL 36362

Chief, Atmospheric Sciences Div
Code ES-81
NASA
Marshall Space Flight Center,
AL 35812

Commander
US Army Missile R&D Command
ATTN: DRDMI-CGA (B. W. Fowler)
Redstone Arsenal, AL 35809

Redstone Scientific Information Center
ATTN: DRDMI-TBD
US Army Missile R&D Command
Redstone Arsenal, AL 35809

Commander
US Army Missile R&D Command
ATTN: DRDMI-TEM (R. Haraway)
Redstone Arsenal, AL 35809

Commander
US Army Missile R&D Command
ATTN: DRDMI-TRA (Dr. Essenwanger)
Redstone Arsenal, AL 35809

Commander
HQ, Fort Huachuca
ATTN: Tech Ref Div
Fort Huachuca, AZ 85613

Commander
US Army Intelligence Center & School
ATTN: ATSI-CD-MD
Fort Huachuca, AZ 85613

Commander
US Army Yuma Proving Ground
ATTN: Technical Library
Bldg 2100
Yuma, AZ 85364

Naval Weapons Center (Code 3173)
ATTN: Dr. A. Shlanta
China Lake, CA 93555

Sylvania Elec Sys Western Div
ATTN: Technical Reports Library
PO Box 205
Mountain View, CA 94040

Geophysics Officer
PMTC Code 3250
Pacific Missile Test Center
Point Mugu, CA 93042

Commander
Naval Ocean Systems Center (Code 4473)
ATTN: Technical Library
San Diego, CA 92152

Meteorologist in Charge
Kwajalein Missile Range
PO Box 67
APO San Francisco, CA 96555

Director
NOAA/ERL/APCL R31
RB3-Room 567
Boulder, CO 80302

Library-R-51-Tech Reports
NOAA/ERL
320 S. Broadway
Boulder, CO 80302

National Center for Atmos Research
NCAR Library
PO Box 3000
Boulder, CO 80307

R. B. Girardo
Bureau of Reclamation
E&R Center, Code 1220
Denver Federal Center, Bldg 67
Denver, CO 80225

National Weather Service
National Meteorological Center
W321, WWB, Room 201
ATTN: Mr. Quiroz
Washington, DC 20233

Mil Assistant for Atmos Sciences
Ofc of the Undersecretary of Defense
for Rsch & Engr/E&LS - Room 3D129
The Pentagon
Washington, DC 20301

Defense Communications Agency
Technical Library Center
Code 205
Washington, DC 20305

Director
Defense Nuclear Agency
ATTN: Technical Library
Washington, DC 20305

HQDA (DAEN-RDM/Dr. de Percin)
Washington, DC 20314

Director
Naval Research Laboratory
Code 5530
Washington, DC 20375

Commanding Officer
Naval Research Laboratory
Code 2627
Washington, DC 20375

Dr. J. M. MacCallum
Naval Research Laboratory
Code 1409
Washington, DC 20375

The Library of Congress
ATTN: Exchange & Gift Div
Washington, DC 20540
2

Head, Atmos Rsch Section
Div Atmospheric Science
National Science Foundation
1800 G. Street, NW
Washington, DC 20550

CPT Hugh Albers, Exec Sec
Interdept Committee on Atmos Science
National Science Foundation
Washington, DC 20550

Director, Systems R&D Service
Federal Aviation Administration
ATTN: ARD-54
2100 Second Street, SW
Washington, DC 20590

ADTC/DLODL
Eglin AFB, FL 32542

Naval Training Equipment Center
ATTN: Technical Library
Orlando, FL 32813

Det 11, 2WS/OI
ATTN: Maj Orondorff
Patrick AFB, FL 32925

USAFETAC/CB
Scott AFB, IL 62225

HQ, ESD/TOSI/S-22
Hanscom AFB, MA 01731

Air Force Geophysics Laboratory
ATTN: LCB (A. S. Carten, Jr.)
Hanscom AFB, MA 01731

Air Force Geophysics Laboratory
ATTN: LYD
Hanscom AFB, MA 01731

Meteorology Division
AFGL/LY
Hanscom AFB, MA 01731

US Army Liaison Office
MIT-Lincoln Lab, Library A-082
PO Box 73
Lexington, MA 02173

Director
US Army Ballistic Rsch Lab
ATTN: DRDAR-BLB (Dr. G. E. Keller)
Aberdeen Proving Ground, MD 21005

Commander
US Army Ballistic Rsch Lab
ATTN: DRDAR-BLP
Aberdeen Proving Ground, MD 21005

Director
US Army Armament R&D Command
Chemical Systems Laboratory
ATTN: DRDAR-CLJ-I
Aberdeen Proving Ground, MD 21010

Chief CB Detection & Alarms Div
Chemical Systems Laboratory
ATTN: DRDAR-CLC-CR (H. Tannenbaum)
Aberdeen Proving Ground, MD 21010

Commander
Harry Diamond Laboratories
ATTN: DELHD-CO
2800 Powder Mill Road
Adelphi, MD 20783

Commander
ERADCOM
ATTN: DRDEL-AP
2800 Powder Mill Road
Adelphi, MD 20783
2

Commander
ERADCOM
ATTN: DRDEL-CG/DRDEL-DC/DRDEL-CS
2800 Powder Mill Road
Adelphi, MD 20783

Commander
ERADCOM
ATTN: DRDEL-CT
2800 Powder Mill Road
Adelphi, MD 20783

Commander
ERADCOM
ATTN: DRDEL-EA
2800 Powder Mill Road
Adelphi, MD 20783

Commander
ERADCOM
ATTN: DRDEL-PA/DRDEL-ILS/DRDEL-E
2800 Powder Mill Road
Adelphi, MD 20783

Commander
ERADCOM
ATTN: DRDEL-PAO (S. Kimmel)
2800 Powder Mill Road
Adelphi, MD 20783

Chief
Intelligence Materiel Dev & Support Ofc
ATTN: DELEW-WL-I
Bldg 4554
Fort George G. Meade, MD 20755

Acquisitions Section, IRDB-D823
Library & Info Service Div, NOAA
6009 Executive Blvd
Rockville, MD 20852

Naval Surface Weapons Center
White Oak Library
Silver Spring, MD 20910

The Environmental Research
Institute of MI
ATTN: IRIA Library
PO Box 8618
Ann Arbor, MI 48107

Mr. William A. Main
USDA Forest Service
1407 S. Harrison Road
East Lansing, MI 48823

Dr. A. D. Belmont
Research Division
PO Box 1249
Control Data Corp
Minneapolis, MN 55440

Director
Naval Oceanography & Meteorology
NSTL Station
Bay St Louis, MS 39529

Director
US Army Engr Waterways Experiment Sta
ATTN: Library
PO Box 631
Vicksburg, MS 39180

Environmental Protection Agency
Meteorology Laboratory
Research Triangle Park, NC 27711

US Army Research Office
ATTN: DRXRO-PP
PO Box 12211
Research Triangle Park, NC 27709

Commanding Officer
US Army Armament R&D Command
ATTN: DRDAR-TSS Bldg 59
Dover, NJ 07801

Commander
HQ, US Army Avionics R&D Activity
ATTN: DAVAA-O
Fort Monmouth, NJ 07703

Commander/Director
US Army Combat Surveillance & Target
Acquisition Laboratory
ATTN: DELCS-D
Fort Monmouth, NJ 07703

Commander
US Army Electronics R&D Command
ATTN: DELCS-S
Fort Monmouth, NJ 07703

US Army Materiel Systems
Analysis Activity
ATTN: DRXSY-MP
Aberdeen Proving Ground, MD 21005

Director
US Army Electronics Technology &
Devices Laboratory
ATTN: DELET-D
Fort Monmouth, NJ 07703

Commander
US Army Electronic Warfare Laboratory
ATTN: DELEW-D
Fort Monmouth, NJ 07703

Commander
US Army Night Vision &
Electro-Optics Laboratory
ATTN: DELNV-L (Dr. Rudolf Buser)
Fort Monmouth, NJ 07703

Commander
ERADCOM Technical Support Activity
ATTN: DELSD-L
Fort Monmouth, NJ 07703

Project Manager, FIREFINDER
ATTN: DRCPM-FF
Fort Monmouth, NJ 07703

Project Manager, REMBASS
ATTN: DRCPM-RBS
Fort Monmouth, NJ 07703

Commander
US Army Satellite Comm Agency
ATTN: DRCPM-SC-3
Fort Monmouth, NJ 07703

Commander
ERADCOM Scientific Advisor
ATTN: DRDEL-SA
Fort Monmouth, NJ 07703

6585 TG/WE
Holloman AFB, NM 88330

AFWL/WE
Kirtland, AFB, NM 87117

AFWL/Technical Library (SUL)
Kirtland AFB, NM 87117

Commander
US Army Test & Evaluation Command
ATTN: STEWS-AD-L
White Sands Missile Range, NM 88002

Rome Air Development Center
ATTN: Documents Library
TSLD (Bette Smith)
Griffiss AFB, NY 13441

Commander
US Army Tropic Test Center
ATTN: STETC-TD (Info Center)
APO New York 09827

Commandant
US Army Field Artillery School
ATTN: ATSF-CD-R (Mr. Farmer)
Fort Sill, OK 73503

Commandant
US Army Field Artillery School
ATTN: ATSF-CF-R
Fort Sill, OK 73503

Director CFD
US Army Field Artillery School
ATTN: Met Division
Fort Sill, OK 73503

Commandant
US Army Field Artillery School
ATTN: Morris Swett Library
Fort Sill, OK 73503

Commander
US Army Dugway Proving Ground
ATTN: MT-DA-L
Dugway, UT 84022

Dr. C. R. Sreedrahan
Research Associates
Utah State University, UNC 48
Logan, UT 84322

Inge Dirmhirn, Professor
Utah State University, UNC 48
Logan, UT 84322

Defense Documentation Center
ATTN: DDC-TCA
Cameron Station Bldg 5
Alexandria, VA 22314
12

Commanding Officer
US Army Foreign Sci & Tech Center
ATTN: DRXST-IS1
220 7th Street, NE
Charlottesville, VA 22901

Naval Surface Weapons Center
Code G65
Dahlgren, VA 22448

Commander
US Army Night Vision
& Electro-Optics Lab
ATTN: DELNV-D
Fort Belvoir, VA 22060

Commander and Director
US Army Engineer Topographic Lab
ETL-TD-MB
Fort Belvoir, VA 22060

Director
Applied Technology Lab
DAVDL-EU-TSD
ATTN: Technical Library
Fort Eustis, VA 23604

Department of the Air Force
OL-C, 5WW
Fort Monroe, VA 23651

Department of the Air Force
5WW/DN
Langley AFB, VA 23665

Director
Development Center MCDEC
ATTN: Firepower Division
Quantico, VA 22134

US Army Nuclear & Chemical Agency
ATTN: MONA-WE
Springfield, VA 22150

Director
US Army Signals Warfare Laboratory
ATTN: DELSW-OS (Dr. R. Burkhardt)
Vint Hill Farms Station
Warrenton, VA 22186

Commander
US Army Cold Regions Test Center
ATTN: STECR-OP-PM
APO Seattle, WA 98733

Dr. John L. Walsh
Code 5560
Navy Research Lab
Washington, DC 20375

Commander
TRASANA
ATTN: ATAA-PL
(Dolores Anguiano)
White Sands Missile Range, NM 88002

Commander
US Army Dugway Proving Ground
ATTN: STEDP-MT-DA-M (Mr. Paul Carlson)
Dugway, UT 84022

Commander
US Army Dugway Proving Ground
ATTN: STEDP-MT-DA-T
(Mr. William Peterson)
Dugway, UT 84022

Commander
USATRADOC
ATTN: ATCD-SIE
Fort Monroe, VA 23651

Commander
USATRADOC
ATTN: ATCD-CF
Fort Monroe, VA 23651

Commander
USATRADOC
ATTN: Tech Library
Fort Monroe, VA 23651

ATMOSPHERIC SCIENCES RESEARCH PAPERS

1. Lindberg, J.D., "An Improvement to a Method for Measuring the Absorption Coefficient of Atmospheric Dust and other Strongly Absorbing Powders," ECOM-5565, July 1975.
2. Avara, Elton, P., "Mesoscale Wind Shears Derived from Thermal Winds," ECOM-5566, July 1975.
3. Gomez, Richard B., and Joseph H. Pierluissi, "Incomplete Gamma Function Approximation for King's Strong-Line Transmittance Model," ECOM-5567, July 1975.
4. Blanco, A.J., and B.F. Engebos, "Ballistic Wind Weighting Functions for Tank Projectiles," ECOM-5568, August 1975.
5. Taylor, Fredrick J., Jack Smith, and Thomas H. Pries, "Crosswind Measurements through Pattern Recognition Techniques," ECOM-5569, July 1975.
6. Walters, D.L., "Crosswind Weighting Functions for Direct-Fire Projectiles," ECOM-5570, August 1975.
7. Duncan, Louis D., "An Improved Algorithm for the Iterated Minimal Information Solution for Remote Sounding of Temperature," ECOM-5571, August 1975.
8. Robbiani, Raymond L., "Tactical Field Demonstration of Mobile Weather Radar Set AN/TPS-41 at Fort Rucker, Alabama," ECOM-5572, August 1975.
9. Miers, B., G. Blackman, D. Langer, and N. Lorimier, "Analysis of SMS/GOES Film Data," ECOM-5573, September 1975.
10. Manquero, Carlos, Louis Duncan, and Rufus Bruce, "An Indication from Satellite Measurements of Atmospheric CO2 Variability," ECOM-5574, September 1975.
11. Petracca, Carmine, and James D. Lindberg, "Installation and Operation of an Atmospheric Particulate Collector," ECOM-5575, September 1975.
12. Avara, Elton P., and George Alexander, "Empirical Investigation of Three Iterative Methods for Inverting the Radiative Transfer Equation," ECOM-5576, October 1975.
13. Alexander, George D., "A Digital Data Acquisition Interface for the SMS Direct Readout Ground Station — Concept and Preliminary Design," ECOM-5577, October 1975.
14. Cantor, Israel, "Enhancement of Point Source Thermal Radiation Under Clouds in a Nonattenuating Medium," ECOM-5578, October 1975.
15. Norton, Colburn, and Glenn Hoidale, "The Diurnal Variation of Mixing Height by Month over White Sands Missile Range, N.M," ECOM-5579, November 1975.
16. Avara, Elton P., "On the Spectrum Analysis of Binary Data," ECOM-5580, November 1975.
17. Taylor, Fredrick J., Thomas H. Pries, and Chao-Huan Huang, "Optimal Wind Velocity Estimation," ECOM-5581, December 1975.
18. Avara, Elton P., "Some Effects of Autocorrelated and Cross-Correlated Noise on the Analysis of Variance," ECOM-5582, December 1975.
19. Gillespie, Patti S., R.L. Armstrong, and Kenneth O. White, "The Spectral Characteristics and Atmospheric CO2 Absorption of the Ho^{+3}:YLF Laser at 2.05μm," ECOM-5583, December 1975.
20. Novlan, David J. "An Empirical Method of Forecasting Thunderstorms for the White Sands Missile Range," ECOM-5584, February 1976.
21. Avara, Elton P., "Randomization Effects in Hypothesis Testing with Autocorrelated Noise," ECOM-5585, February 1976.
22. Watkins, Wendell R., "Improvements in Long Path Absorption Cell Measurement," ECOM-5586, March 1976.
23. Thomas, Joe, George D. Alexander, and Marvin Dubbin, "SATTEL — An Army Dedicated Meteorological Telemetry System," ECOM-5587. March 1976.
24. Kennedy, Bruce W., and Delbert Bynum, "Army User Test Program for the RDT&E-XM-75 Meteorological Rocket," ECOM-5588, April 1976.

25. Barnett, Kenneth M., "A Description of the Artillery Meteorological Comparisons at White Sands Missle Range, October 1974 - December 1974 ('PASS' - Prototype Artillery [Meteorological] Subsystem)," ECOM-5589, April 1976.
26. Miller, Walter B., "Preliminary Analysis of Fall-of-Shot From Project 'PASS'," ECOM-5590, April 1976.
27. Avara, Elton P., "Error Analysis of Minimum Information and Smith's Direct Methods for Inverting the Radiative Transfer Equation," ECOM-5591, April 1976.
28. Yee, Young P., James D. Horn, and George Alexander, "Synoptic Thermal Wind Calculations from Radiosonde Observations Over the Southwestern United States," ECOM-5592, May 1976.
29. Duncan, Louis D., and Mary Ann Seagraves, "Applications of Empirical Corrections to NOAA-4 VTPR Observations," ECOM-5593, May 1976.
30. Miers, Bruce T., and Steve Weaver, "Applications of Meterological Satellite Data to Weather Sensitive Army Operations,"ECOM-5594, May 1976.
31. Sharenow, Moses, "Redesign and Improvement of Balloon ML-566," ECOM-5595, June, 1976.
32. Hansen, Frank V., "The Depth of the Surface Boundary Layer," ECOM-5596, June 1976.
33. Pinnick, R.G., and E.B. Stenmark, "Response Calculations for a Commercial Light-Scattering Aerosol Counter," ECOM-5597, July 1976.
34. Mason, J., and G.B. Hoidale, "Visibility as an Estimator of Infrared Transmittance," ECOM-5598, July 1976.
35. Bruce, Rufus E., Louis D. Duncan, and Joseph H. Pierluissi, "Experimental Study of the Relationship Between Radiosonde Temperatures and Radiometric-Area Temperatures," ECOM-5599, August 1976.
36. Duncan, Louis D., "Stratospheric Wind Shear Computed from Satellite Thermal Sounder Measurements," ECOM-5800, September 1976.
37. Taylor, F., P. Mohan, P. Joseph and T. Pries, "An All Digital Automated Wind Measurement System," ECOM-5801, September 1976.
38. Bruce, Charles, "Development of Spectrophones for CW and Pulsed Radiation Sources," ECOM-5802, September 1976.
39. Duncan, Louis D., and Mary Ann Seagraves,"Another Method for Estimating Clear Column Radiances," ECOM-5803, October 1976.
40. Blanco, Abel J., and Larry E. Taylor, "Artillery Meteorological Analysis of Project Pass," ECOM-5804, October 1976.
41. Miller, Walter, and Bernard Engebos," A Mathematical Structure for Refinement of Sound Ranging Estimates," ECOM-5805, November, 1976.
42. Gillespie, James B., and James D. Lindberg, "A Method to Obtain Diffuse Reflectance Measurements from 1.0 to 3.0 μm Using a Cary 17I Spectrophotometer," ECOM-5806, November 1976.
43. Rubio, Roberto, and Robert O. Olsen,"A Study of the Effects of Temperature Variations on Radio Wave Absorption,"ECOM-5807, November 1976.
44. Ballard, Harold N., "Temperature Measurements in the Stratosphere from Balloon-Borne Instrument Platforms, 1968-1975," ECOM-5808, December 1976.
45. Monahan, H.H., "An Approach to the Short-Range Prediction of Early Morning Radiation Fog," ECOM-5809, January 1977.
46. Engebos, Bernard Francis, "Introduction to Multiple State Multiple Action Decision Theory and Its Relation to Mixing Structures," ECOM-5810, January 1977.
47. Low, Richard D.H.,"Effects of Cloud Particles on Remote Sensing from Space in the 10-Micrometer Infrared Region," ECOM-5811, January 1977.
48. Bonner, Robert S., and R. Newton, "Application of the AN/GVS-5 Laser Rangefinder to Cloud Base Height Measurements," ECOM-5812, February 1977.
49. Rubio, Roberto, "Lidar Detection of Subvisible Reentry Vehicle Erosive Atmospheric Material," ECOM-5813, March 1977.
50. Low, Richard D.H., and J.D. Horn, "Mesoscale Determination of Cloud-Top Height: Problems and Solutions," ECOM-5814, March 1977.

51. Duncan, Louis D., and Mary Ann Seagraves,"Evaluation of the NOAA-4 VTPR Thermal Winds for Nuclear Fallout Predictions," ECOM-5815, March 1977.
52. Randhawa, Jagir S., M. Izquierdo, Carlos McDonald and Zvi Salpeter, "Stratospheric Ozone Density as Measured by a Chemiluminescent Sensor During the Stratcom VI-A Flight," ECOM-5816, April 1977.
53. Rubio, Roberto, and Mike Izquierdo, "Measurements of Net Atmospheric Irradiance in the 0.7- to 2.8-Micrometer Infrared Region," ECOM-5817, May 1977.
54. Ballard, Harold N., Jose M. Serna, and Frank P. Hudson Consultant for Chemical Kinetics, "Calculation of Selected Atmospheric Composition Parameters for the Mid-Latitude, September Stratosphere," ECOM-5818, May 1977.
55. Mitchell, J.D., R.S. Sagar, and R.O. Olsen, "Positive Ions in the Middle Atmosphere During Sunrise Conditions," ECOM-5819, May 1977.
56. White, Kenneth O., Wendell R. Watkins, Stuart A. Schleusener, and Ronald L. Johnson, "Solid-State Laser Wavelength Identification Using a Reference Absorber," ECOM-5820, June 1977.
57. Watkins, Wendell R., and Richard G. Dixon, "Automation of Long-Path Absorption Cell Measurements," ECOM-5821, June 1977.
58. Taylor, S.E., J.M. Davis, and J.B. Mason, "Analysis of Observed Soil Skin Moisture Effects on Reflectance," ECOM-5822, June 1977.
59. Duncan, Louis D. and Mary Ann Seagraves, "Fallout Predictions Computed from Satellite Derived Winds," ECOM-5823. June 1977.
60. Snider, D.E., D.G. Murcray, F.H. Murcray, and W.J. Williams, "Investigation of High-Altitude Enhanced Infrared Backround Emissions" (U), SECRET, ECOM-5824, June 1977.
61. Dubbin, Marvin H. and Dennis Hall, "Synchronous Meteorlogical Satellite Direct Readout Ground System Digital Video Electronics," ECOM-5825, June 1977.
62. Miller, W., and B. Engebos, "A Preliminary Analysis of Two Sound Ranging Algorithms," ECOM-5826, July 1977.
63. Kennedy, Bruce W., and James K. Luers, "Ballistic Sphere Techniques for Measuring Atomspheric Parameters," ECOM-5827, July 1977.
64. Duncan, Louis D., "Zenith Angle Variation of Satellite Thermal Sounder Measurements," ECOM-5828, August 1977.
65. Hansen, Frank V., "The Critical Richardson Number," ECOM-5829, September 1977.
66. Ballard, Harold N., and Frank P. Hudson (Compilers), "Stratospheric Composition Balloon-Borne Experiment," ECOM-5830, October 1977.
67. Barr, William C., and Arnold C. Peterson, "Wind Measuring Accuracy Test of Meteorological Systems," ECOM-5831, November 1977.
68. Ethridge, G.A. and F.V. Hansen, "Atmospheric Diffusion: Similarity Theory and Empirical Derivations for Use in Boundary Layer Diffusion Problems," ECOM-5832, November 1977.
69. Low, Richard D.H., "The Internal Cloud Radiation Field and a Technique for Determining Cloud Blackness," ECOM-5833, December 1977.
70. Watkins, Wendell R., Kenneth O. White, Charles W. Bruce, Donald L. Walters, and James D. Lindberg, "Measurements Required for Prediction of High Energy Laser Transmission," ECOM-5834, December 1977.
71. Rubio, Robert, "Investigation of Abrupt Decreases in Atmospherically Backscattered Laser Energy," ECOM-5835. December 1977.
72. Monahan, H.H. and R.M. Cionco, "An Interpretative Review of Existing Capabilities for Measuring and Forecasting Selected Weather Variables (Emphasizing Remote Means)," ASL-TR-0001, January 1978.
73. Heaps, Melvin G., "The 1979 Solar Eclipse and Validation of D-Region Models," ASL-TR-0002. March 1978.

74. Jennings, S.G., and J.B. Gillespie, "M.I.E. Theory Sensitivity Studies - The Effects of Aerosol Complex Refractive Index and Size Distribution Variations on Extinction and Absorption Coefficients Part II: Analysis of the Computational Results," ASL-TR-0003, March 1978.

75. White, Kenneth O. et al, "Water Vapor Continuum Absorption in the 3.5μm to 4.0μm Region," ASL-TR-0004, March 1978.

76. Olsen, Robert O., and Bruce W. Kennedy, "ABRES Pretest Atmospheric Measurements," ASL-TR-0005, April 1978.

77. Ballard, Harold N., Jose M. Serna, and Frank P. Hudson, "Calculation of Atmospheric Composition in the High Latitude September Stratosphere," ASL-TR-0006, May 1978.

78. Watkins, Wendell R. et al, "Water Vapor Absorption Coefficients at HF Laser Wavelengths," ASL-TR-0007, May 1978.

79. Hansen, Frank V., "The Growth and Prediction of Nocturnal Inversions," ASL-TR-0008, May 1978.

80. Samuel, Christine, Charles Bruce, and Ralph Brewer, "Spectrophone Analysis of Gas Samples Obtained at Field Site," ASL-TR-0009, June 1978.

81. Pinnick, R.G. et al., "Vertical Structure in Atmospheric Fog and Haze and its Effects on IR Extinction," ASL-TR-0010, July 1978.

82. Low, Richard D.H., Louis D. Duncan, and Richard B. Gomez, "The Microphysical Basis of Fog Optical Characterization," ASL-TR-0011, August 1978.

83. Heaps, Melvin G., "The Effect of a Solar Proton Event on the Minor Neutral Constituents of the Summer Polar Mesosphere," ASL-TR-0012, August 1978.

84. Mason, James B., "Light Attenuation in Falling Snow," ASL-TR-0013, August 1978.

85. Blanco, Abel J., "Long-Range Artillery Sound Ranging: "PASS" Meteorological Application," ASL-TR-0014, September 1978.

86. Heaps, M.G., and F.E. Niles, "Modeling the Ion Chemistry of the D-Region: A case Study Based Upon the 1966 Total Solar Eclipse," ASL-TR-0015, September 1978.

87. Jennings, S.G., and R.G. Pinnick, "Effects of Particulate Complex Refractive Index and Particle Size Distribution Variations on Atmospheric Extinction and Absorption for Visible Through Middle-Infrared Wavelengths," ASL-TR-0016, September 1978.

88. Watkins, Wendell R., Kenneth O. White, Lanny R. Bower, and Brian Z. Sojka, " Pressure Dependence of the Water Vapor Continuum Absorption in the 3.5- to 4.0-Micrometer Region," ASL-TR-0017, September 1978.

89. Miller, W.B., and B.F. Engebos, "Behavior of Four Sound Ranging Techniques in an Idealized Physical Enviroment," ASL-TR-0018, September 1978.

90. Gomez, Richard G., "Effectiveness Studies of the CBU-88/B Bomb, Cluster, Smoke Weapon" (U), CONFIDENTIAL ASL-TR-0019, September 1978.

91. Miller, August, Richard C. Shirkey, and Mary Ann Seagraves, "Calculation of Thermal Emission from Aerosols Using the Doubling Technique," ASL-TR-0020, November, 1978.

92. Lindberg, James D. et al., "Measured Effects of Battlefield Dust and Smoke on Visible, Infrared, and Millimeter Wavelengths Propagation: A Preliminary Report on Dusty Infrared Test-I (DIRT-I)," ASL-TR-0021, January 1979.

93. Kennedy, Bruce W., Arthur Kinghorn, and B.R. Hixon, "Engineering Flight Tests of Range Meteorological Sounding System Radiosonde," ASL-TR-0022, February 1979.

94. Rubio, Roberto, and Don Hoock, "Microwave Effective Earth Radius Factor Variability at Wiesbaden and Balboa," ASL-TR-0023, February 1979.

95. Low, Richard D.H., "A Theoretical Investigation of Cloud/Fog Optical Properties and Their Spectral Correlations," ASL-TR-0024, February 1979.

96. Pinnick, R.G., and H.J. Auvermann, "Response Characteristics of Knollenberg Light-Scattering Aerosol Counters," ASL-TR-0025, February 1979.
97. Heaps, Melvin G., Robert O. Olsen, and Warren W. Berning, "Solar Eclipse 1979, Atmospheric Sciences Laboratory Program Overview," ASL-TR-0026 February 1979.
98. Blanco, Abel J., "Long-Range Artillery Sound Ranging: 'PASS' GR-8 Sound Ranging Data," ASL-TR-0027, March 1979.
99. Kennedy, Bruce W., and Jose M. Serna, "Meteorological Rocket Network System Reliability," ASL-TR-0028, March 1979.
100. Swingle, Donald M., "Effects of Arrival Time Errors in Weighted Range Equation Solutions for Linear Base Sound Ranging," ASL-TR-0029, April 1979.
101. Umstead, Robert K., Ricardo Pena, and Frank V. Hansen, "KWIK: An Algorithm for Calculating Munition Expenditures for Smoke Screening/Obscuration in Tactical Situations," ASL-TR-0030, April 1979.
102. D'Arcy, Edward M., "Accuracy Validation of the Modified Nike Hercules Radar," ASL-TR-0031, May 1979.
103. Rodriguez, Ruben, "Evaluation of the Passive Remote Crosswind Sensor," ASL-TR-0032, May 1979.
104. Barber, T.L., and R. Rodriguez, "Transit Time Lidar Measurement of Near-Surface Winds in the Atmosphere," ASL-TR-0033, May 1979.
105. Low, Richard D.H., Louis D. Duncan, and Y.Y. Roger R. Hsiao, "Microphysical and Optical Properties of California Coastal Fogs at Fort Ord," ASL-TR-0034, June 1979.
106. Rodriguez, Ruben, and William J. Vechione, "Evaluation of the Saturation Resistant Crosswind Sensor," ASL-TR-0035, July 1979

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979 — 677-017/18